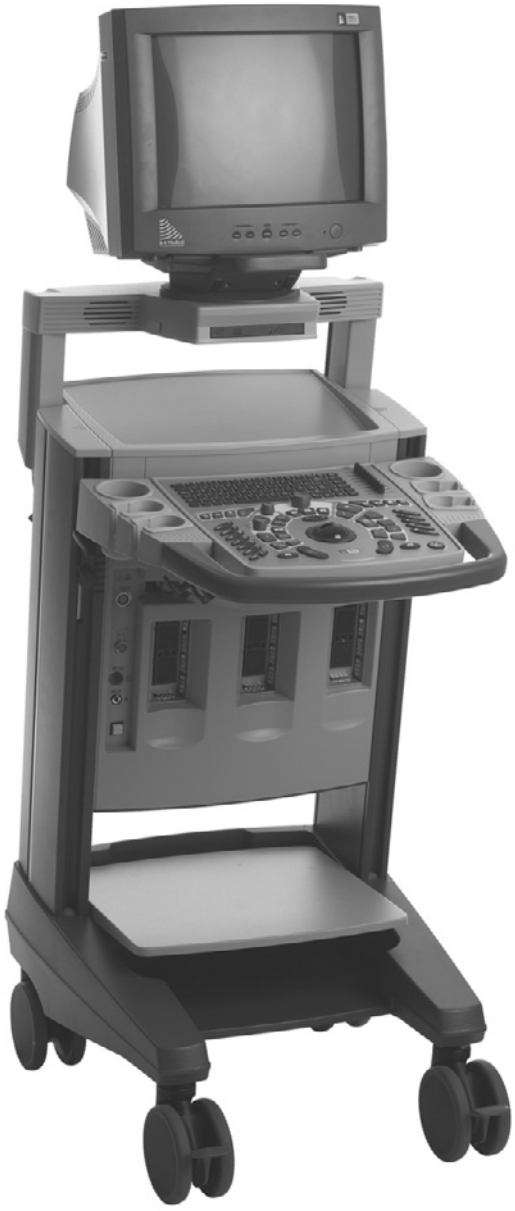
Pro Focus 2202
Extended User Guide



English
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June 2005

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Part 1: Basics

Chapter 1
General and Safety Information

This user guide is for the Pro Focus 2202 Ultrasound Scanner from B-K Medical. The scanner is a 2D and 3D ultrasound echo and flow imaging system for diagnosis, data processing and transfer, guidance of puncture and biopsy, and ECG signal superposition. It is not for continuous operation (mode of operation is not continuous).

Before using the scanner, please make yourself familiar with the operating instructions in this guide and in the *General Transducer Information* (BB0555) manual.

Make sure that you also read the transducer user guide and specifications for each transducer that you use. The transducer user guides contain specific information about operating and caring for each transducer. Acoustic output data and data about EMC (electromagnetic compatibility) for all transducers used with this scanner are on a CD (BZ2100) that accompanies this user guide.

This chapter contains important safety information that you should be aware of before you use the scanner. The remaining chapters also contain safety information.

About this User Guide

The chapters in this user guide are divided into Parts.

- *Part 1 – Basics* contains information you need to know before you start scanning.
- *Part 2 – Working with the Image* describes the user interface and how to work with it. It also contains general information about adjusting and working with the scanned image as well as how to make basic measurements.
- *Part 3 – Imaging Modes* contains chapters dealing with information specific to each of the scanning modes.
- *Part 4 – Setting Up and Maintaining Your System* tells you how to care for your scanner and how to set up and customize your system if you do not want to use the predefined setups.
- *Part 5 – Pro Packages* contains chapters for the various clinical application areas and 3D.
- *Part 6 – Appendixes* – The appendixes include a glossary of terms and a chapter containing technical information (including important information about electrical safety and about dismantling the scanner for transportation). Finally, there is an appendix listing the specifications for the scanner.

Safety Information

This user guide contains cautions, warnings and other information about what you must do to ensure the safe and proper performance of the ultrasound scanner. You must also follow local government rules and guidelines at all times.

Important safety information is indicated in the user guide by means of special formatting.

WARNING Warnings contain information that is important for avoiding personal injury.

Caution: Cautions contain information and instructions that must be followed to avoid damaging equipment, data or software.

NOTE: *Notes contain information that you should be aware of.*

Typographical Conventions

The following typographical conventions are used in this manual:

FREEZE – a function, something you can do by using the keyboard panel or the graphical user interface on the screen

Freq. – text that can be selected or clicked on the screen

[**Power**]– a key on the keyboard panel

Book Titles – names of books and scientific journals

[1] References. Literature references are found at the end of the chapter.

Terminology

Many of the terms and abbreviations used in this user guide are defined in the Glossary starting on page 315.

Instructions

You control the scanner by using the graphical user interface on the screen, pressing keys on the control panel, or typing on the keyboard. Instructions in this user guide tell you what sort of action to take.

When the instructions say	It means
Click **Power**	Use the trackball to point at the word “Power” on the screen, and then press [ ] (**Select**) on the control panel.
Press [**Power**]	Press the **Power** key on the control panel.
Press [**Sound**]	Press the **Sound** key on the control panel.
Type **`Power`**	Type the word “Power” on the keyboard.

Table 1-1. Click, Press and Type.

About the Scanner

The Pro Focus 2202 Ultrasound Scanner is easy to use. You can perform most scanner operations using just the trackball and the trackball keys to interact with controls on the screen. Dedicated keys on the control panel make other operations quick and easy.

Scanning Modes

The Pro Focus lets you use various scanning modes:

- B-mode (brightness mode) for real-time imaging of soft tissues: includes harmonic imaging
- Color mode (CFM, color flow mapping, color Doppler mode) for information about flow direction and velocity
- Power mode (power Doppler mode) for higher sensitivity to flow information: includes directional Power Doppler
- Doppler mode (spectral Doppler mode) for information about the spectrum of flow velocities as a function of time
- CW Doppler mode (continuous wave Doppler) for information about high-velocity flow
- M-mode for information about tissue motion as a function of time

Pro Packages

Pro Packages contain default Diagnostic Setups and calculation formulas that make it quick and convenient to use the scanner for specific applications.

Safety Symbols on the Scanner

Important safety information is indicated in the user guide and on the scanner itself by means of special symbols and formatting.

Table 1-2 contains brief explanations of the safety symbols used to label the scanner. (Some labels in the table may appear on the transducer rather than the scanner itself.)

NOTE *especially the following:*

⚠ When you encounter this sign on the scanner, consult the user guide for important safety information.

B-K Medical disclaims all responsibility for the operating safety, reliability and performance of the equipment if these symbols and warnings are disregarded in any way.

Symbol	Name	Description
⚠	Caution or Warning	Consult accompanying user guide (BB 1279) when you encounter this sign on the instrument, to avoid reducing its safety.
	Potential Equalization	Terminal connected to the chassis. Should be connected to corresponding terminals on other equipment to eliminate potential differences.
	Ground (earth)	Additional protective ground (earth).
	Type BF	BF: Isolated from ground. Maximum patient leakage current under • Normal condition ≤100 µA • Single-fault condition ≤500 µA
	Type B	B: Maximum patient leakage current under • Normal condition ≤100µA • Single-fault condition ≤500µA
IP	Sealing	Dust- and immersion-protected according to EN 60529 [1].
	Standby	Standby switch on front of scanner – used to turn scanner on and off.
	Non-ionizing radiation	Ultrasound scanner emits acoustic radiation.
STERILE	STERILE	Device is in a sterile condition.
	Not watertight	Plug may not be immersed (unless it is covered with a special watertight plug cover).
	ESD (electrostatic discharge)	Do not touch pins in connectors with this symbol unless you follow ESD precautionary procedures.

Table 1-2. Warning symbols on the scanner.

CE Marks on Electrical Devices

The European Union has introduced directives requiring CE marks on devices.

Non-medical devices marked with CE comply with relevant directives, for example EEC Council Directive 89/336/EEC of 3 May 1989 concerning Electromagnetic Compatibility.

B-K Medical devices marked with CE or CE 0543 comply with EEC Council Directive 93/42/EEC of 14 June 1993 concerning Medical Devices. CE applies to Class I medical devices. CE 0543 applies to Classes Im, IIa, IIb and III. B-K Medical defines classes assuming scanning duration for individual patients does not exceed 60 minutes.

General Safety Precautions

The ultrasound scanner is designed and tested in accordance with EN/IEC 60601-1 [2] and EN 60601–2–37 [3]. It complies with requirements for Class 1 (protective earth) devices of EN/IEC 60601-1 [2]. It also complies with UL 2601-1 [4] and CSA C22.2 No. 601.1–M90 [5]. It fulfills the requirements for dust protection (IP20) for ordinary equipment specified in EN 60529 [1].

WARNING Federal law in North America restricts this device to sale to, or on the order of, a physician.

Equipment failure

WARNING If at any time the scanner malfunctions, or the image is severely distorted or degraded, or you suspect in any way that the scanner is not functioning correctly:

- Remove all transducers from contact with the patient.
- Turn off the scanner. Unplug the scanner from the wall and make sure it cannot be used until it has been checked.
- Do not remove the scanner cover.
- Contact your B-K Medical representative or hospital technician.

Isolating the scanner

WARNING The power supply cord connects the scanner to the line voltage. To isolate the scanner, you must unplug the power supply cord from the wall outlet. Do this before you try to make any repairs to the system.

Condensation

Caution: Large variations in temperature or humidity may cause water to condense inside the scanner. If this happens, the scanner may fail to operate properly. Always let the scanner come to room temperature before you plug it in.

- Wait at least 2 hours after the scanner has been subjected to major changes in temperature or humidity.
- If there is visible evidence of condensation, wait at least 8 hours.

Before you use the scanner, make sure that all the safety requirements described in this chapter have been satisfied.

Explosion Hazards

Explosion hazards

WARNING The ultrasound scanner is not designed to be used in potentially explosive environments. It should not be operated in the presence of flammable liquids or gases, or in oxygen-enriched atmospheres.

There is a possible explosion hazard if the scanner is used in the presence of flammable anesthetic. The scanner should be placed at least 25 cm (10 inches) from the patient.

The ultrasound scanner contains a lithium battery. Never remove or replace this battery. The lithium battery must not be removed except by a B-K Medical service representative.

Electrical Safety

Do not use a power strip

WARNING Do not plug the scanner into an ordinary power strip. If the ground connection fails, this is dangerous because

- the total leakage current for all the connected equipment can exceed the limits specified in EN/IEC 60601-1 [2].
- the impedance of the ground connection will probably also exceed the limits specified in EN/IEC 60601-1.

Leakage current

WARNING When the equipment is used with 230 V (and you believe the leakage current would be within the UL limit if you were using 120 V), power to the equipment must come from an installation or supply unit with a center-tapped, 240V single-phase circuit. This will make sure that chassis leakage current during single fault condition fulfills the requirements specified in UL 2601-1 [4] (limit of 300 µA). If power is not supplied in the way specified, the leakage current can be as high as 500 µA, the limit specified in EN/IEC 60601-1. [2]

Electrical shock

WARNING Never remove the cover to get access to the inside of the scanner. You risk electrical shock if you do so. Do not allow anyone but qualified service personnel to service the scanner.

ESD

WARNING Do not touch pins in connectors that have this symbol. Do not connect anything to them unless you follow these ESD (electrostatic discharge) precautionary procedures:

- Discharge your body to ground before you touch the pins with your hand or a tool. For example, touch an unpainted metal part of the scanner cover.
- You can use a wrist strap connected to the additional protective ground or potential equalization terminal on the scanner if that is more convenient.

Anyone using the equipment should be taught to recognize the ESD symbol and to take the necessary precautionary procedures.

Interference

Electrical Noise

Electrical noise

WARNING Electrical noise from nearby devices such as electrosurgical devices – or from devices that can transmit electrical noise to the AC line – may cause disturbances in ultrasound images. This could increase the risk during diagnostic or interventional procedures.

Electromagnetic Interference

Medical electrical equipment requires special precautions regarding EMC (electromagnetic compatibility). You must follow the instructions in this chapter when you install the scanner and put it into service.

If the image is distorted, it may be necessary to position the scanner further from sources of electromagnetic interference or to install magnetic shielding.

Other equipment nearby

WARNING Do not use this equipment adjacent to other equipment. If you must place it next to or stacked with other equipment, verify that it operates normally there and neither causes nor is affected by electromagnetic interference.

EMC noise can reduce the usable image depth. Therefore, in order to avoid having to repeat an ultrasound examination, you must make sure beforehand that the ultrasound system can be used for the examination. Repeating an examination can be regarded as a potential risk that should be avoided, especially if the examination involves transducers used intracorporeally or transducers used for puncture.

RF (Radio Frequency) Interference

Portable and mobile RF (radio frequency) communication equipment can affect the scanner, but the scanner will remain safe and meet essential performance requirements.

An ultrasound scanner intentionally receives RF electromagnetic energy for the purpose of its operation. The transducers are very sensitive to frequencies within their signal frequency range (0.5 MHz to 35 MHz). Therefore RF equipment operating in this frequency range can affect the ultrasound image. However, if disturbances occur, they will appear as white lines in the ultrasound picture and cannot be confused with physiological signals.

WARNING Other equipment may interfere with the scanner, even if that other equipment complies with CISPR (International Special Committee on Radio Interference) emission requirements.

WARNING If you use accessories, transducers or cables with the scanner, other than those specified, increased emission or decreased immunity of the system may result.

Installation

Installation safety requirements

WARNING To ensure safe performance, a qualified electrical engineer or hospital safety personnel must verify that the ultrasound scanner is correctly installed and that it complies with the safety requirements described below:

- Use only the original power supply cord. This must be fitted with a hospital-approved three-prong grounded power plug. See “Power Supply Cord” on page 331.
- The equipment must only be connected to a grounded AC power supply (or wall outlet) that meets EN/IEC/NEC requirements or applicable local regulations. The examination room’s grounding system should be checked regularly by a qualified electronics engineer or hospital safety personnel.
- Never use extension cables. The increased length of the cable will increase the resistance of the protective ground conductor beyond an acceptable level.
- Keep power supply cords, sockets and plugs clean and dry at all times.

Secure the power cord

WARNING Make sure that the power cord cannot be accidentally disconnected from the wall or the scanner.

Transducers

Electrical shock

WARNING The transducer sockets contain terminals with 5V. To avoid coming in contact with these voltages, always connect transducers to cover empty sockets while you use the scanner.

Type B transducers

WARNING When using Type B (non-isolated) transducers, carefully check all electrical equipment within the patient area. Also, consider using additional protective grounding.

Electrical burns

WARNING Do not leave transducers in contact with the patient when using HF electrosurgical equipment.

B-K Medical transducers fulfill EMC requirements when they are outside as well as inside the patient’s body.

Care

Please refer to the *General Transducer Information* (BB0555) manual for information about caring for transducers.

Other Safety Considerations

Mechanical failure or unintended use of ultrasound equipment can result in physical injury to patients or operators.

Mechanical injury

WARNING Be careful to avoid the following potential sources of injury:

- Parts of the body can be pinched by moveable parts of the scanner, such as the keyboard panel and the monitor.
- Tilting the scanner can cause it to be unstable and injure someone.
- Do not lean or sit on the keyboard. The keyboard panel or monitor can break if subjected to heavy weights or impact.

Service and Repair

Authorized personnel

WARNING Service and repair of B-K Medical electromedical equipment must be carried out only by the manufacturer or its authorized representatives. B-K Medical reserves the right to disclaim all responsibility for the operating safety, reliability and performance of equipment serviced or repaired by other parties. After repairs have been carried out, a qualified electrical engineer or hospital technician should verify the safety of all equipment.

Connecting Other Equipment

⚠ **WARNING** Consult this user guide before connecting other equipment to terminals marked with ⚠ .

To fulfill EMC requirements, do not attach cables to the scanner unless they are the same type as listed in Table B-2 on page 324 and do not exceed the maximum length given in the table. Do not attach transducers and other accessories unless the user guide for the transducer or accessory states that it can be used with this scanner. Attaching other equipment may cause an increase in electromagnetic emissions or may cause the scanner to be more sensitive to electromagnetic interference.

The scanner must not be galvanically connected to a computer network (DICOM) that has not been isolated. If the network is not isolated, the scanner must be connected via a network isolator DP0925 (see “Accessories”, starting on page 341).

Medical equipment

WARNING Equipment that complies with the requirements of EN/IEC 60601–1 [2], UL 2601-1 [4] or CSA C22.2 No. 601.1–M90 [5] can be connected to the scanner, but the power for the equipment must come from the auxiliary power output on the scanner or from an independent wall power outlet. You can use the isolated auxiliary power outlets on the scanner to connect equipment such as a monitor or video printer requiring a total of 350VA or less. Otherwise, you can plug the scanner and other equipment into an external common isolation transformer in order to control the leakage current during a ground connection fault. Follow the guidelines in EN60601–1–1 [6]. If in doubt, contact your local B-K Medical representative.

Non-medical equipment: location, standards and power supply

WARNING If you connect non-medical equipment (instruments that do not comply with safety requirements for medical equipment), this equipment must be placed outside the patient environment (1.5 m from the bed, for example). The equipment must fulfill the relevant EN standard or other applicable national or international standard.

The power for the equipment must come from the auxiliary power output on the scanner. You can use the isolated auxiliary power outlets on the scanner to connect equipment such as a monitor or video printer requiring a total of 350VA or less. Otherwise, you can plug the scanner and other equipment into an external common isolation transformer in order to control the leakage current during a ground connection fault. Follow the guidelines in EN60601–1–1 [6]. If in doubt, contact your local B-K Medical representative.

Computer Security

When the Pro Focus is connected to a hospital network, B-K Medical does not take any responsibility for computer viruses from the network that may infect the Pro Focus.

Acoustic Output

General

Medical research has yet to prove whether or not ultrasound causes biological effects. Therefore, prudent use considerations require you to follow certain guidelines [3].

Prudent Use

Exposure level

WARNING Always keep the exposure level (the acoustic output level and the exposure time) as low as possible.

- Scan patients only when clinical reasons make it necessary.
- Keep exposure time as short as possible.
- Be careful to prepare the patient correctly so that you get the best possible image.
- Start scanning at a low acoustic output level (see “Thermal and Mechanical Indices” on page 28) and increase the level only as much as necessary to obtain a satisfactory image.
- If you switch from an application requiring high acoustic output levels (see “Functions Affecting Acoustic Output” on page 29), to one that requires lower levels (fetal scanning, for example), be sure to reset the levels before you scan. (For example, start in B-mode.)
- Take into account all the types of tissue that may be affected. For example, when scanning a breast, it may be appropriate to monitor the TI in bone rather than in soft tissue because the ribs will be subjected to ultrasound.

Training requirements

WARNING Before attempting to use B-K Medical equipment, you should be trained in ultrasonography or be under the supervision of someone who is trained in ultrasonography. You should also be thoroughly familiar with the safe operation of your ultrasound system and should always use the transducer best suited to the examination.

Acoustic output data for transducers used with the scanner are given on a CD (BZ2100) that accompanies this user guide. The uncertainty level for each parameter measured is listed in the user guide for each transducer. For definitions of the parameters, refer to the Food and Drug Administration (FDA) Guide [7] as well as EN 60601-2-37 [3] and AIUM/NEMA standards [8,9].

In North America, the FDA requires all ultrasound equipment to be cleared before it is marketed in the United States.

The routes (or tracks) available for clearance by the FDA are well-defined. Track 3 is for diagnostic ultrasound systems that follow the Output Display Standard. Under Track 3, acoustic output will not be evaluated on an application-specific basis, but the maximum derated Spatial Peak–Temporal Average Intensity (I_{SPTA}) must be $\leq 720\,mW/cm^2$, the maximum Mechanical Index (MI) must be ≤ 1.9, and the maximum Thermal Index (TI) must be ≤ 6. All B-K Medical transducers for use with the Pro Focus 2202 Ultrasound Scanner are Track 3.

Monitor Display

The Mechanical Index (MI) and Thermal Index (TI) can be viewed in all scanning modes.

Thermal and Mechanical Indices

The MI and TI indices are intended to allow users to implement the ALARA [10, 11] (As Low As Reasonably Achievable) principle using an indicator related to a potential bioeffect.

The full details of the indices are given in references [3] and [9], but the formulas are given below.

MI Formula

$$MI = \frac{P_{r0.3}(z_{sp})}{\sqrt{f_c}}$$

where the variables are defined in the table below.

Variable	Definition
$P_{r0.3}(z_{sp})$	Peak Rarefactional Pressure (MPa), derated by 0.3 dB/cm·MHz, measured at z_{sp}, the point on the beam axis where pulse intensity integral ($PII_{0.3}$) is maximum
f_c	measured center frequency (in MHz)

TI Formula

$$TI = \frac{W_0}{W_{deg}}$$

where the variables are defined in the table below.

Variable	Definition
W_0	time-averaged acoustic power of the source or other power parameter (W)
W_{deg}	estimated power necessary to raise the temperature of the target tissue one degree Celsius (W/°C)

Blood perfusion and TI

As a rule of thumb, the Thermal Index (TI) indicates the highest expected temperature increase in degrees Celsius. It is based on an average level of blood perfusion. The displayed TI may underestimate the temperature rise in poorly perfused tissues; you must take this into account when deciding on the maximum TI you will allow. Conversely, in areas with a rich perfusion of blood the temperature increase will be less than the displayed TI indicates.

Fever

A temperature increase of one degree Celsius increase in a patient with fever may cause complications in certain circumstances; it may be safer to delay the investigation.

Acoustic Output Measurement

All values are measured in water according to the EN and AIUM/NEMA display standards [3, 8, 9]. For the some of the acoustic parameters, an estimated in situ derated value is given. This is derived assuming a tissue attenuation of 0.3 dB/cm·MHz when the estimated in situ derated value (I) is described by the following equation:

I formula

$$I = I_w \exp(-0.069 f z)$$

where the variables are defined in the table below.

Variable	Definition
I_w	Intensity in water at the position where I is maximum
f	transducer frequency (in MHz)
z	distance (in cm) from the transducer face to the position where I is maximum

It should be stressed that the in situ values given are only applicable when there is attenuating tissue between the transducer face and the focal point.

Possibility of Adverse Effects

Although it is believed that diagnostic ultrasound causes no significant biological effects in mammalian tissue [3, 9], the user should be aware of the hypothetical possibilities of adverse effects [10, 12, 13].

Fetal scanning

Current scientific and clinical concern over possible adverse effects is particularly focused on fetal ultrasound scanning. It is due to the increased sensitivity of mammalian cells and organs at this phase of their development and the fact that such a risk could have profound implications on public health. If you use high acoustic output levels for some reason (see “Functions Affecting Acoustic Output”, below), be sure to return to B-mode alone and turn down the power level before you do any fetal scanning.

Functions Affecting Acoustic Output

The scanner has a control function that ensures that neither the I_{SPTA} nor MI nor TI value exceeds the maximum allowable value. When necessary, the scanner will reduce the output voltage and/or PRF (pulse repetition frequency) to the transducer in order to comply with requirements.

Some of the scanner functions can affect the acoustic output, as listed here. (Instructions for using these functions are given in the relevant sections of this user guide.)

- Sizing functions such as ROI (region of interest) – in general, smaller size results in higher acoustic intensity because the pulse repetition frequency (PRF) is higher or the ultrasound beam is more strongly focused.
- Focus – in general, strongly focusing the beam makes the acoustic intensity higher.
- Frame rate – higher frame rate results in higher acoustic intensity.
- Range – increasing the Doppler range increases the acoustic intensity by increasing the PRF.
- CFM Resolution – higher resolution increases the acoustic output.
- Color box size – narrowing the color box generally increases the acoustic output within it.

The user can set a Thermal Index limit. This will provide an upper limit for acoustic output.

Default Acoustic Output

After the scanner has been turned off, the transducers will start in the default setup when the scanner is turned on again. The default setup may be factory-defined or defined by the user.

The factory-defined default setup values of acoustic output for each transducer are listed in the *General Transducer Information* (BB0555) manual.

These setups have been optimized to give the best compromise between low acoustic output and enough power to obtain the image features as quickly as possible. This is part of the ALARA principle. The factory default setup for all transducers is B-Mode to ensure the lowest acoustic output when you start scanning.

To change the default setup to another that satisfies the ALARA principle, see Chapter 13, “Setting Up and Customizing Your System”.

When you enter a new patient ID, the transducer setup will be reset to the default setup. You can prevent this from happening – see “Keeping Image Settings” on page 40.

Fetal scanning

When you use transducers intended for fetal scanning, it is important to make sure that the default settings are appropriate and to reset to the default setting before scanning a new patient.

References

[1] EN 60529:1991+A1:2000. *Specification for degrees of protection provided by enclosures (IP code).*

[2] EN/IEC 60601-1:1990+A1:1993+A2:1995+A13:1996 *Medical electrical equipment. Part 1: General requirements for safety.*

[3] EN 60601-2-37:2001+A1:2005 *Medical electrical equipment – Part 2-37: Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment.*

[4] UL 2601-1:2003 *Medical Electrical Equipment – Part 1. General Requirements for safety.*

[5] CSA C22.2 No. 601.1–M90:2001 *Medical Electrical Equipment – Part 1. General Requirements for safety.*

[6] EN 60601–1–1:2001 *Medical electrical equipment –Part 1-1: General requirements for safety. Collateral standard: Safety requirements for medical electrical systems.*

[7] *Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers.* FDA Center for Devices and Radiological Health. September 1997.

[8] *Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment.* AIUM/NEMA. 1998.

[9] *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment.* AIUM/NEMA. 1998.

[10] *Medical Ultrasound Safety.* AIUM. 1994.

[11] *ALARA Training Program.* Ultrasound III Training. B-K Medical. 1993.

[12] Bioeffects considerations for the safety of diagnostic ultrasound. *Journal of Ultrasound in Medicine*, Vol. 7, No. 9 (supplement). September 1988.

[13] *The safety of diagnostic ultrasound.* The British Institute of Radiology. 1987.

AIUM: American Institute of Ultrasound in Medicine
CSA: Canadian Standards Association
EN: European Standards
FDA: Food and Drug Administration (USA)
IEC: International Electrotechnical Commission
NEC: National Electrical Code
NEMA: National Electrical Manufacturers Association
UL: Underwriters Laboratories Inc., USA

Chapter 2
Getting Started

General Information

Before you turn on the scanner, make sure that the installation has been approved by a qualified electrical engineer or hospital safety personnel. See “Installation” on page 24.

The controls you need to operate the scanner are located on the front.

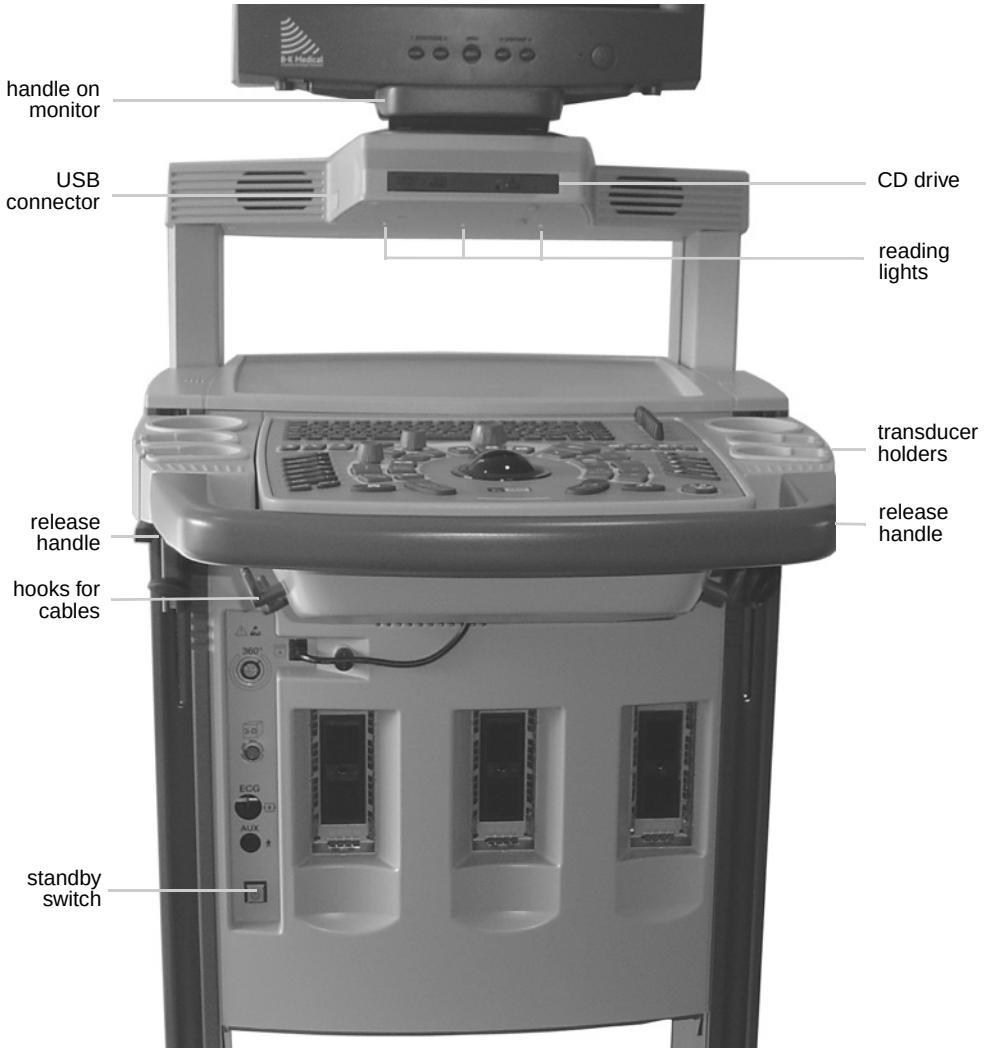


Figure 2-1. The front of the scanner.

Adjusting the Keyboard Panel and Monitor

You can easily adjust the position of the monitor and keyboard panel to make scanning comfortable for the operator.

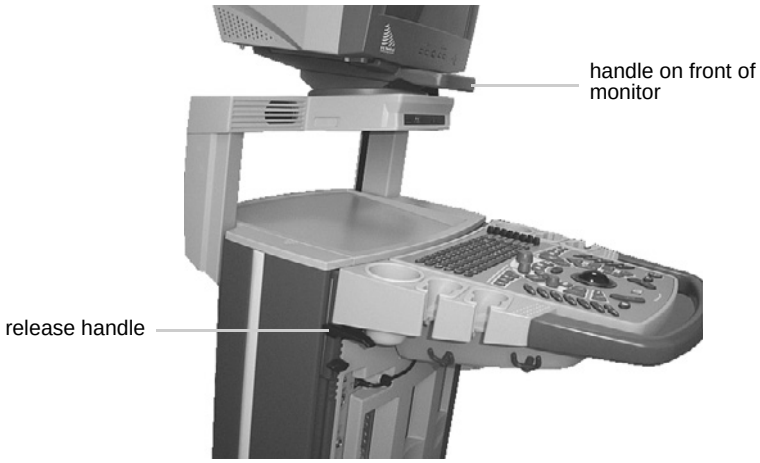


Figure 2-2. Handles for adjusting keyboard panel and monitor.

Up and down

To adjust the height of the keyboard panel:

1. Grab the panel on both sides and pull up on the two release handles.
2. Move the panel up or down.

   The monitor moves up and down together with the keyboard panel.
3. Release the handles when the panel is at the height you want.

Angle

To change the viewing angle of the monitor:

- Use the handle on the front of the monitor to swivel it from side to side and tilt the screen up or down.

Turning the Scanner On and Off

⏻ To turn the scanner on and off, use the green standby switch on the front of the scanner.

To turn the scanner on:

- Press the standby switch ONCE. A startup screen with progress bar is displayed. Wait until the startup screen disappears and the display on the screen is stable, indicating that the scanner is ready to use. Do not try to use the scanner until it is fully ready.

To turn the scanner off:

- Make sure the scanner is completely up and running. Then press the standby switch ONCE.

Wait after you press standby switch

Caution: Whenever you turn the scanner on or off, you must give the operating system of the scanner PC enough time to save and recover open files and unsaved data. Otherwise, a serious system failure may occur that requires technical support.

Wait to unplug

Never unplug the scanner from the wall without turning off the standby switch and waiting for its light to go out.

If you turn off the scanner without following the recommended procedure (for example, if you unplug it while it is running), the next time you turn the scanner on, it may take a longer time to start, and the scanner may be permanently damaged.

Checking the Date

Check that the date displayed on the screen is correct before you start scanning a new patient (or at least at the beginning of each day).

WARNING An incorrect date will make documentation of the image incorrect and may also cause some calculated values to be incorrect.

One cause of an incorrect date is battery failure. The battery fails very rarely. If it does fail, the scanner will usually not operate at all, so you will know to call a technician. However, under certain unusual circumstances the scanner will operate, but the date will be incorrectly set to a default date.

Adjusting the Brightness of the Screen

Your scanner may be used with different levels of room lighting. Whenever the lighting changes significantly, you should recalibrate the screen brightness.

To calibrate the screen brightness:

1. Freeze the image.
2. Press [**Alt+Shift+G**] on the keyboard.

   A series of gray bars appears on a black background.
3. Use the contrast button on the monitor to adjust the bars so that the 100% bar is bright white and the 90% to 10% bars seem to decrease progressively in brightness.
4. Use the brightness button on the monitor to increase the brightness until the 1%, 2% and 3% bars (above the 10% bar) become visible.
5. Use the brightness button to decrease the brightness until the background becomes black and the 1% bar just disappears.

Adjusting the Reading Lights

After you have turned on the scanner, you can adjust the brightness of the 3 reading lights under the CD drive. (See Fig 2-1.)

To adjust the reading light brightness:

- Click **Light** under **Image** on the right side of the screen and drag the slider ((or point at **Light** and press [**+/-**]).

Setting up a New Patient

Before you scan a new patient, you must open the **Patient** window and enter some information about the patient, including the patient ID. The fields in the **Patient** window contain information about the patient and the examination.

Patient ID required

WARNING You must enter a new patient ID before you scan a new patient. Otherwise the documentation will not contain the correct patient identification, and you will not be able to capture images and clips. We recommend that you enter the complete name of the patient.

Opening the Patient Window

There are two ways to open the **Patient** window.

Opening the Patient window

To open the Patient window:

- Press [**ID**].

or

- Click **Enter Patient....** or the name of the previous patient in the identification area on the screen.

  The **Patient** window opens.

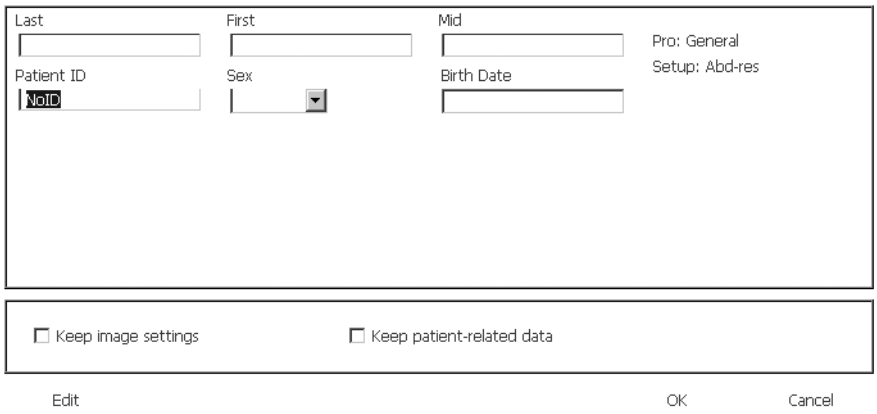


Figure 2-3. The Patient window.

Change the Pro Package first

Some fields in the **Patient** window are different, depending on which Pro Package is selected. Therefore, if you want to change the Pro Package, make sure you do it before you enter information about the patient. See the next section for how to do this.

If DICOM is installed on your scanner, the **Patient** window may look like the one in Fig 2-4.

Changing Pro Package or Diagnostic Setup in the Patient Window

When the **Patient** window opens, a default Pro Package and a default Diagnostic Setup are displayed in the window.

To change Pro Package or Diagnostic Setup in the Patient window:

1. Point at the name of the Pro Package or Diagnostic Setup.
2. Press [**+/-**] to toggle through the available choices.

Click to save patient data and go to Pro Package menu window

If you click one of the default setups (instead of toggling through the choices), the data in the **Patient** window are saved and the **Pro Package** menu window appears. You can select a different Pro Package and Diagnostic Setup from the menu. See “Selecting a Pro Package or Diagnostic Setup” on page 42. After you select something from the menu, the **Pro Package** menu window closes. If you have selected a new Diagnostic Setup, scanning begins. If you have selected a new Pro Package, the image is frozen when the Patient window closes.

Using the Patient Window

TAB to move between fields

After you have entered information in a field, press [**Tab**] to move from field to field. (You can also move the cursor to a field by clicking the field.)

ENTER closes window

Do not press [**Enter**] (**Return**) unless you want to close the window. [**Enter**] on the keyboard is the same as **OK** in the window.)

Re-opening Patient window

If you decide to enter more patient data after you have started the examination (or if you have closed the **Patient** window by mistake before you have finished entering data), you can re-open the window. To re-open the **Patient** window, click the patient name at the top of the screen. When the (blank) **Patient** window opens, click **Edit** to restore the previously entered patient data to the fields

> **NOTE***: Any information you enter after you re-open the* **Patient** *window will not be transferred to the patient archiving system.*

New Patient Information from a DICOM Worklist

DICOM® is not installed as a default on the scanner. See “DICOM Setup” on page 199 for information about installation and setup, which must be performed by qualified service personnel. If DICOM is installed, the system may be set up so that you can retrieve a worklist of patients and then select a patient from the worklist.

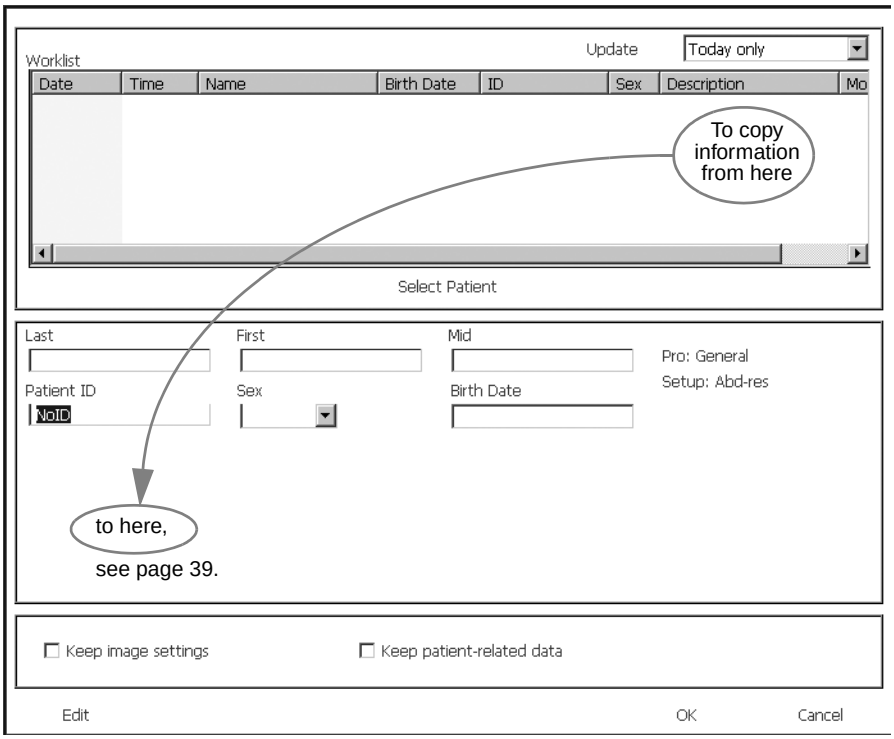


Figure 2-4. The Patient window with worklist

Depending on how your DICOM system is set up, the worklist may appear as soon as you open the **Patient** window. If the worklist is blank, you can retrieve the information.

To retrieve a worklist:

1. Use the drop-down window in the upper right corner to select the dates you want the list to include.
2. Click **Update**.

   The worklist appears in the window. If there are more patients than can fit in the window, you can scroll down to see the rest of the list.

Sorting

To sort the worklist by name, or any other column in the worklist, click the column heading.

To select a patient from the worklist:

1. Click the row that contains the patient.
2. Click **Select Patient**.

   The window closes. The ultrasound image on the screen is not frozen.

Saving description with image

If you want the description from the worklist to be saved with patient data when you save a scanned image, you must type the description into the **Description** field in the **Patient** window *after* you have clicked **Select Patient** (and closed the window). (See Fig 2-4.)

To save a description from the worklist:

1. Open the **Patient** window again.
2. Click **Edit**. See “Re-opening Patient window” on page 37.
3. Type the description from the worklist into the **Description** field.

Worklist not updated

Changes in patient data fields (except PSA) are transferred back to the DICOM system when you save (store) a scanned image, but the worklist is not updated.

NOTE*: Any information you enter after you re-open the* **Patient** *window will not be transferred to the DICOM system.*

Entering Dates

The **Patient** window contains one or more date fields. Dates in these fields can be displayed in various formats.

Format	Example
dd-MM-yyyy	18-11-1944
dd MMM yyyy	18 Nov 1944
MM/dd/yyyy	11/18/1944
MMM/dd/yyyy	Nov/18/1944

Table 2-1. Possible date formats.

The date format is set up in the **General Setup** window, but you probably will not need to change it. See “Date/Time” on page 172.

Use number keys

Use the number keys on the keyboard to enter dates.

> **NOTE:** *You cannot type letters in a date field, even when the month is displayed in letters. In the example in Table 2-1, you must type 11 for the month, even it if is displayed as “Nov”.*

To enter dates in date fields:

1. Put the cursor at the beginning of the date field.
2. Type the date (or number of the month, if your system is set to display month first).
3. Type a separator or press → to move to the next part of the date. You can use any of the following separators: period (.), comma (,), hyphen (-) and slash (/). (The separator you use when you enter a date does not affect the way the date is displayed in the field.)
4. Type the appropriate number.
5. Repeat steps 3 and 4.

Keeping Image Settings

When you enter a new patient ID, the transducer setup is reset to the default for the transducer. If for some reason you want to keep the current settings when you start scanning the new patient, you can prevent the settings from being changed back to the default ones. However, this does not work if you change transducer or Pro Package.

To keep transducer settings:

- Check **Keep image settings** in the **Patient** window.

  The scanner uses the image settings from the previous patient.

Keeping Patient-Related Data

When you enter a new patient ID, the patient-related data are reset to the default values unless you want to keep the setup from the previous patient.

Patient-related data include the following:

- Diagnostic Setup
- Bodymark
- Measurements
- Labels

To keep patient-related data:

- Check **Keep patient-related data** in the **Patient** window.

  The scanner uses the patient-related data from the previous patient.

  NOTE: *You must check both* **Keep image settings** *and* **Keep patient-related data** *if you want to return to the previous frozen image when you close the* **Patient** *window. If you do not check both boxes, the system starts scanning when you close the window, and measurements you have made are lost.*

Connecting and Selecting Transducers

Connecting a Transducer

On the front of the scanner body are 3 sockets for connecting array transducers. There can be a socket for connecting mechanical transducers.

Keep cables tidy

Under the keyboard panel are a number of hooks that can help keep transducer cables tidy and out of the way. (See Fig 2-1.)

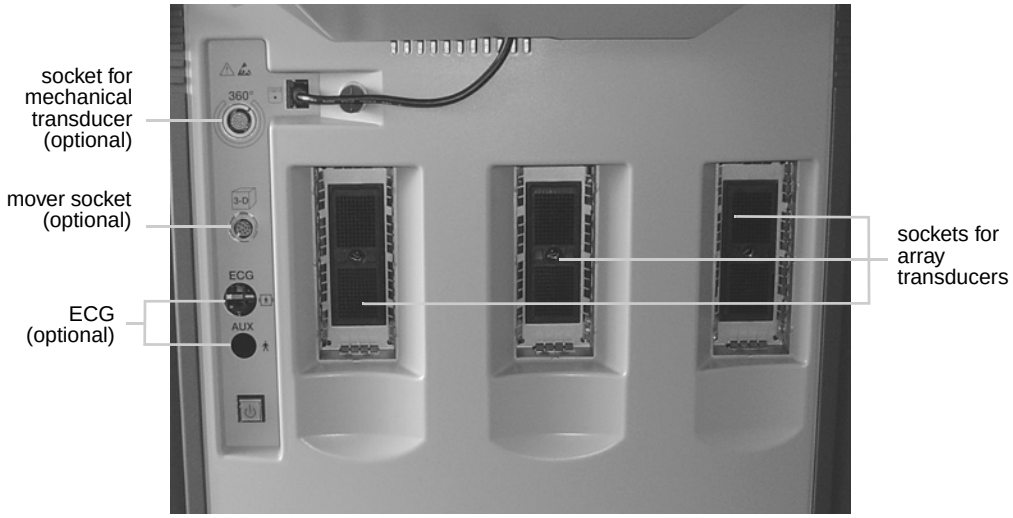


Figure 2-5. The transducer sockets.

To connect a transducer

1. Insert the transducer plug into the socket.
2. Turn the locking lever on the transducer plug clockwise.

To disconnect a transducer:

1. Turn the locking lever on the plug counterclockwise.
2. Remove the plug from the socket.

Transducer Holders

The 4 transducer holders beside the keyboard panel keep the transducers you need safe and ready for use. Transducer-holder inserts (DZ9756) are available to hold the smaller transducers in the B-K Medical range. See Appendix C, “Specifications” for a list of accessories that can be ordered to use with the scanner.

Gel Holders

The two gel holders behind the transducer holders hold gel containers ready for use.

Selecting a Transducer

You can choose to scan with any of the transducers that are connected to the scanner. The type number of the transducer currently selected is displayed, together with the scanning frequency, in the Identification area at the top of the screen. See page 67.

Type number displayed must match number on transducer

WARNING Before you start to scan, make sure that the type number of the transducer you have selected matches the number displayed on the screen. If they do not match, the puncture line on the screen may not correspond to the true puncture path in the tissue. In case of any inconsistency, stop scanning, turn off the scanner, and contact your local B-K Medical representative.

To select a different transducer that can be used with the same Pro Package:

- Point at the transducer type number on the screen and press [**+/-**] to select the transducer you want.

or

- Press the button on the transducer itself (if it has a button).

To change Pro Package as well as transducer, or to see all connected transducers and the Pro Packages that support them, see “Selecting a Pro Package or Diagnostic Setup” on page 42.

Selecting the Scanning Plane

If you are using a biplane transducer, you can select the scanning plane (sagittal or transverse). The current scanning plane (**T** or **S**) is displayed on the at the top of the screen after the transducer type number.

To select the scanning plane:

- Press the appropriate button on the transducer. For details, see the user guide for the transducer.

or

- Click **T** or **S** (whichever is displayed) on the screen and select the value you want, or point at **T** or **S** and press [**+/-**].

The scanning plane in the selected view is updated to the one you select.

Pro Packages and Diagnostic Setups

Each Pro Package contains all the measurement and calculation tools you need for a particular application area. It also contains appropriate Diagnostic Setups for the various transducers that can be used with the Pro Package. Each transducer may have more than one Diagnostic Setup, but one setup will be the default one.

A Diagnostic Setup contains information about the scanning modes that are being used and all the imaging information for those modes.

Selecting a Pro Package or Diagnostic Setup

The system starts scanning with the default Diagnostic Setup for the transducer and Pro Package you are using.

The Pro Package and Diagnostic Setup currently selected are displayed in the Identification area of the screen. See page 67.

To select a Pro Package or Diagnostic Setup:

1 Press [↘] or click the Pro Package or Diagnostic Setup displayed in the identification area of the screen.

The **Pro Package Menu** window appears. It contains a column for each connected transducer. The column lists the Pro Packages and Diagnostic Setups that you can use with that transducer.

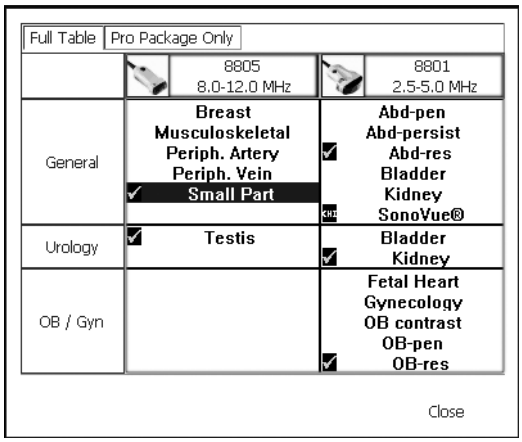


Figure 2-6. The Pro Package Menu window.

2 Select the Pro Package and Diagnostic Setup you want.

3 Click **Close**.

Saving a Diagnostic Setup

When you have changed the setup, you can save it as a new Diagnostic Setup.

To save a Diagnostic Setup:

- Click **Save** under **Image** on the right side of the screen.

Selecting or Changing the Scanning Mode

The scanner is set up to start scanning in B-mode, unless something else is specified in the Pro Package you are using.

To add modes to B-mode, press the key for the mode you want to add.

Performing a Biopsy or Puncture Procedure (including Brachytherapy)

When you use a puncture guide to perform a biopsy or puncture procedure, a puncture line is superimposed on the image. When you use a transducer for brachytherapy, a brachytherapy needle guide matrix (brachy matrix) is superimposed on the image.

Check puncture guide type number

WARNING Always check the type number of the puncture guide displayed on the screen to make sure that it corresponds to the puncture guide that you are actually using. If the number is incorrect, the puncture line on the screen may not correspond to the true puncture path in the tissue.

Check brachy coordinates in window with matrix

WARNING For brachytherapy, make sure that the brachy matrix type and coordinates indicated on the screen (Brachy 5 mm in Fig 2-7) agree with the actual matrix template you are using.

Verify matrix alignment

WARNING Before you use the brachy matrix for seed implantation, check the matrix offset value to verify that it corresponds with the chosen matrix. Then check the matrix alignment. See “Alignment of the Brachy Matrix” on page 206.

Activate puncture guide or brachy matrix

To superimpose a puncture line or brachy matrix on an ultrasound image:

- Press [ ].

  The puncture guide or brachy matrix that you previously selected appears on the scan area unless you have selected a new transducer or Pro Package. In these cases, the default puncture guide or brachy matrix appears.

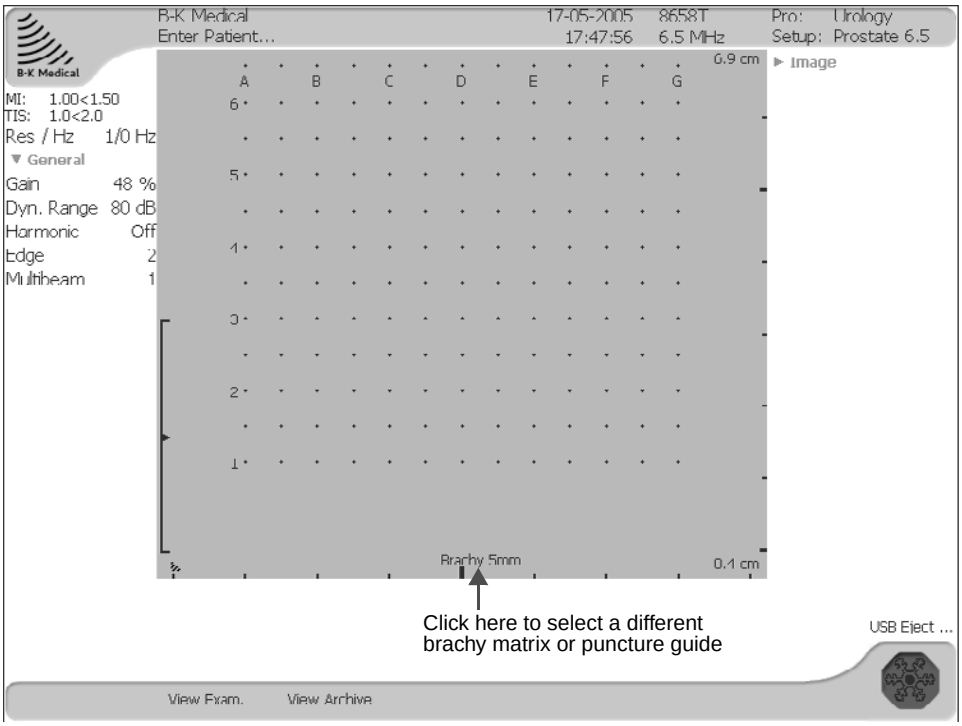


Figure 2-7. A brachy matrix on the scan area.

To select a different puncture guide or brachy matrix:

1 Click the Type number or brachy matrix name displayed at the bottom of the scan area.

The **Puncture Guide** menu appears. It contains the puncture guides and brachy matrices that are available for the selected transducer.

Figure 2-8. The Puncture Guide menu.

2 Click the puncture guide or brachy matrix you want.

The menu disappears and the markings on the scan area are updated.

To remove the puncture line or brachy matrix from the screen:

- Press [ ].

Using the PCU (Palm Control Unit)

Use only UA2410

WARNING Make sure that the PCU is labeled UA2410. See Fig 3-16 on page 70. If you use a different model of PCU, pressing the keys will not have the function you expect.

For a description of the controls on the optional PCU, see Chapter 3, “The User Interface”.

Wait 12 seconds

NOTE: *The PCU receives power from the scanner. After power is applied (either because the scanner has been turned on or because the PCU has been connected after the scanner is already running), the PCU requires 12 seconds to calibrate the mouse stick.*

Do not use the PCU – in particular, do not touch the mouse stick – for 12 seconds after power is applied. If you do not wait 12 seconds, the cursor may drift on the screen, and you will have to unplug the PCU, plug it in again and wait 12 seconds to get control of the cursor.

Attaching the PCU

To connect a Palm Control Unit (PCU) to the Pro Focus, it must first be connected to adaptor UA1271.

To connect the PCU:

1 Connect the PCU to the adaptor. Make sure that the dot on the plug is lined up with the dot on the socket. (see Fig 2-9).

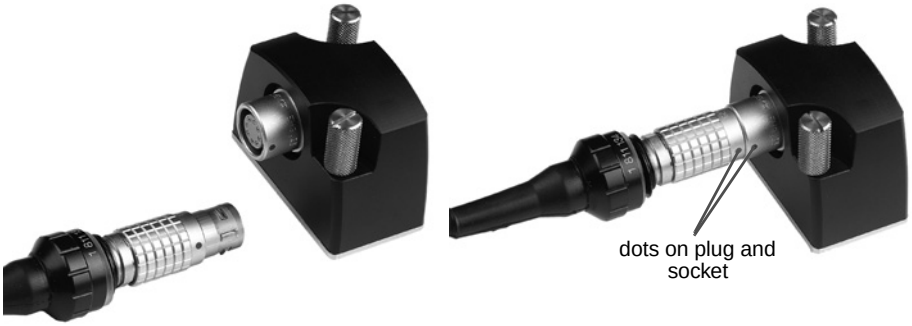


Figure 2-9. Palm Control Unit plug and adaptor UA1271.

2 Connect the adaptor to the ⇔ connector on the rear of the scanner. (See Fig B-2 on page 323.

Checking the PCU

Each time you use the PCU, carefully inspect the PCU connector plug and the rubber ring on the plug before you start. If there are any changes in the color of the plug or the rubber ring (for example, if a grayish color is apparent), the unit must be checked by a B-K Medical service representative before you use it.

The outside surface of the watertight plug cover may change color slightly after repeated disinfection. This does not represent any problem.

For details of cleaning and disinfecting the PCU, see “Palm Control Unit (PCU)” on page 202.

Putting Sterile Covers on the PCU

Sterile covers (one for the PCU and one for the cable) are available for use with the PCU. The package containing the sterile covers (UA0029) contains a PCU cover, a cable cover, clips and some tape.

Latex sensitivity

WARNING Because of reports of severe allergic reactions to medical devices containing latex (natural rubber), the FDA is advising health-care professionals to identify latex-sensitive patients and be prepared to treat allergic reactions promptly [1].

The procedure for putting on the sterile covers is illustrated in Fig 2-10.

To put sterile covers on the PCU and cable:

1 Always wear sterile gloves while you put on the sterile covers.

2 Put the PCU in the sterile PCU cover and twist the cover around the cable so it fits closely.

3 Use the provided tape or clips to fasten the cover to the cable.

4 Pull the accordion-folded cable cover over the plug and attach it to the cable using the clips or tape.

5 Check that the cover has not been damaged by this procedure. If it has, repeat the procedure with a new cover.

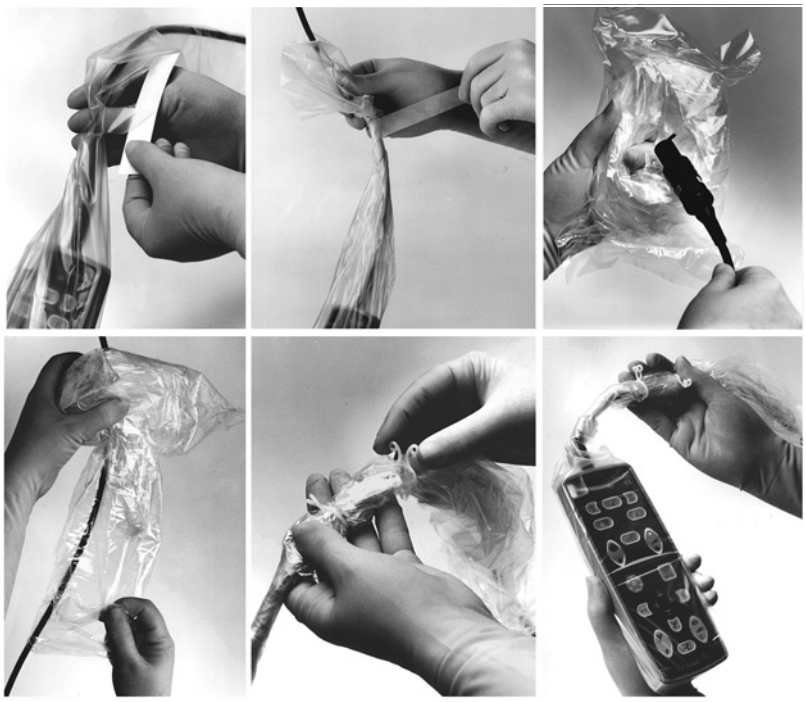


Figure 2-10. Putting on the PCU cover and cable cover.

References

[1] Allergic Reactions to Latex-Containing Medical Devices. FDA Department of Health and Human Services. FDA Medical Alert. March 29, 1991.

Part 2: Working with the Image

Chapter 3
The User Interface

The Pro Focus scanner has 4 types of controls, in addition to buttons on the transducers:

- keyboard panel controls (keys)
- controls on the screen
- foot switch (optional)
- keys on the optional Palm Control Unit (PCU)

This chapter gives an overview of the various controls and how they are used in general. Detailed information about using individual controls is contained in Chapter 4, “Working with the Image” and the chapters that deal with the various scanning modes.

Keyboard Panel Controls

The Pro Focus keyboard panel contains both an alphanumeric keyboard and a control panel with special scanner control keys.

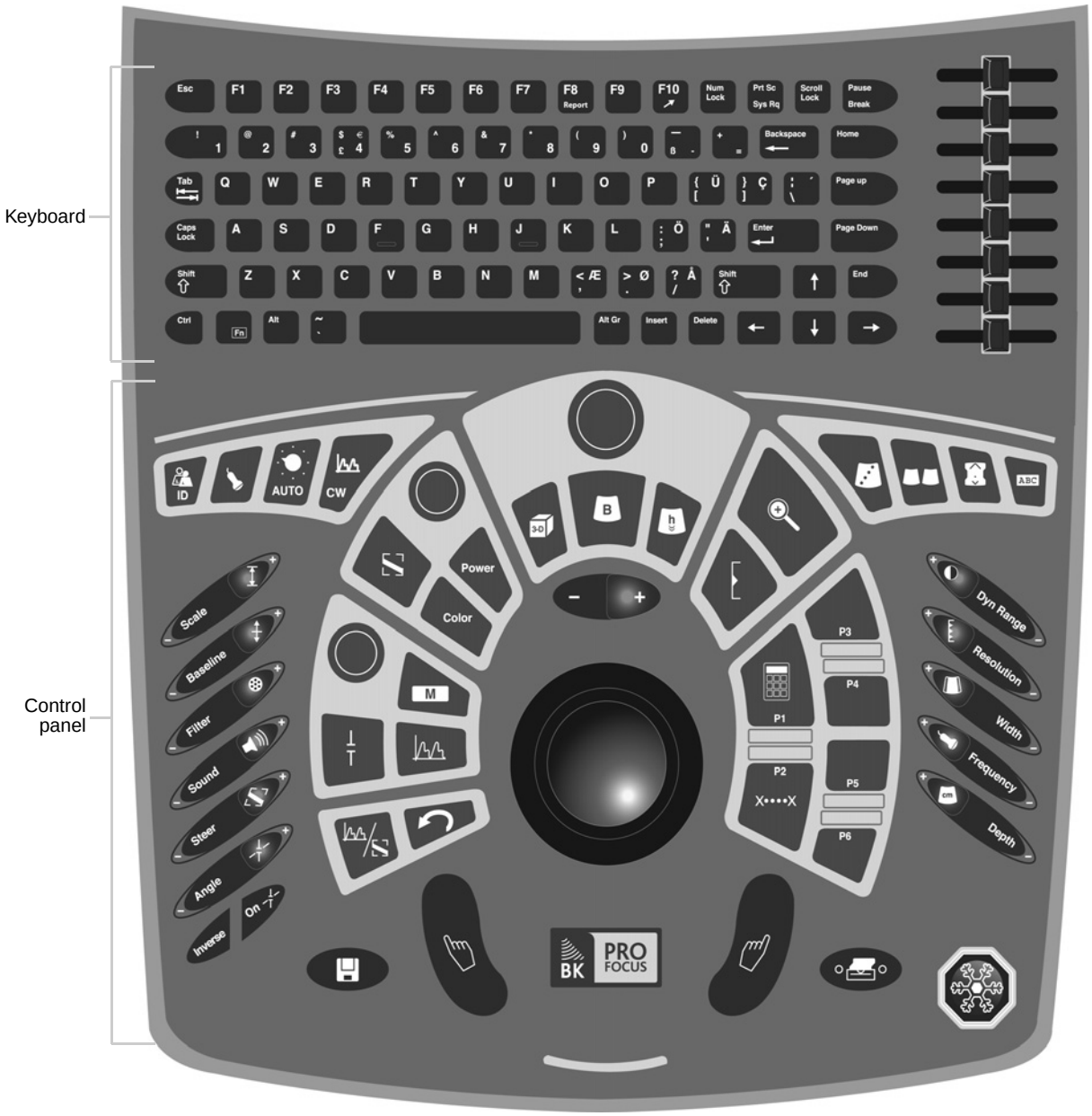


Figure 3-1. The keyboard panel.

The Control Panel

Each control key has a backlighted label that is visible when the functionality of the key is available. Keys turn green to indicate an active function.

There are several types of control keys, categorized according to how you use them.

Key types

Key Type	Example	Action
Trackball	**Trackball**	Rolling the trackball moves a cursor on the screen.
+/-	[**+/-**]	Pressing the key adjusts a value or moves a cursor stepwise up or down (pressing the + side increases the value, pressing the - side decreases it). A long press repeats the action.
Press	[**Color**]	Pressing the key activates a function or turns something on or off. Sometimes a long press (at least one second) is required to turn it off.
Turn	[**Gain**]	Turning adjusts the gain. Turn clockwise to increase the gain, turn counterclockwise to decrease the gain.
Rocker	[**SCALE** ↕]	Same as for the [**+/-**] key.
Slider	**TGC** controls	Moving the slider adjusts a value continuously.

Table 3-1. Control key types.

Press (long)

In some situations, pressing a key normally and pressing it for a longer time (at least one second) have different effects. The longer presses are indicated in this user guide by *press (long)*. A long press usually turns off a function.

The Control Panel Guide

The control panel guide gives a brief overview of the control panel and can be stored in the keyboard base below the keyboard panel.

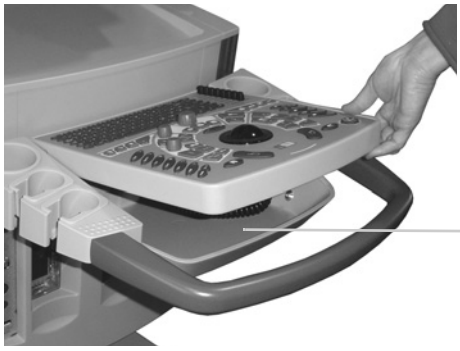


Figure 3-2. Store the control panel guide below the keyboard.

The Trackball and Trackball Keys

The trackball, together with the 2 [☜] (**Select**) keys and the [**+/-**] key, can be used to operate the on-screen controls.

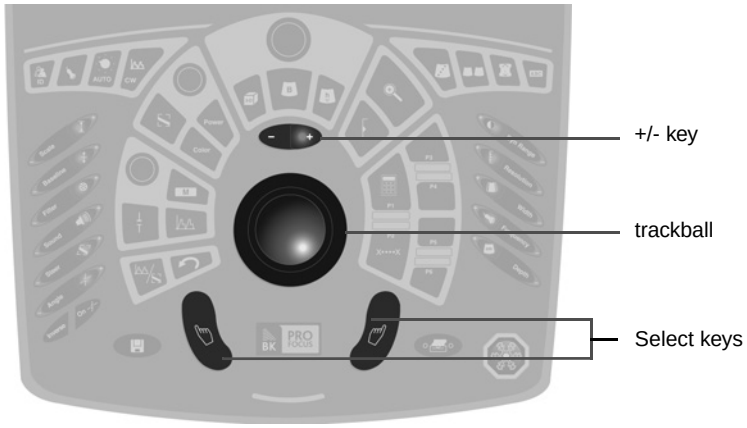


Figure 3-3. The trackball and trackball keys.

Trackball with Select Keys

Like a mouse

The trackball and [ ] (**Select**) keys are used together like a PC mouse.

- Rolling the trackball moves the cursor and other objects on the screen.
- Pressing one of the [ ] keys is like clicking a left mouse button.

There is no difference between the 2 [ ] keys – use the one that is most convenient for you.

Adjusting the Trackball The trackball should move smoothly. If it is too tight or too loose, use the trackball adjustment tool (QA0228) to adjust it.

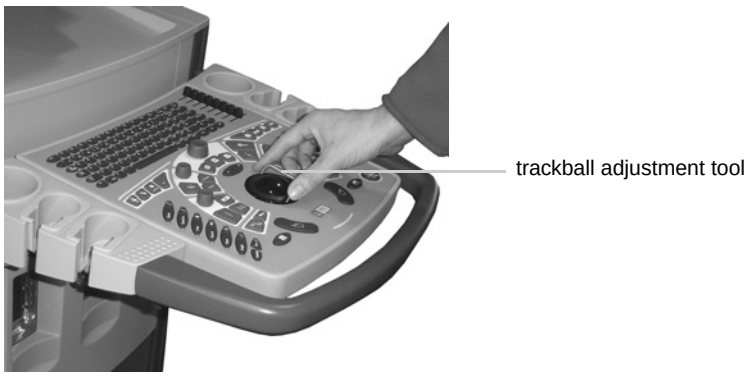


Figure 3-4. Using the trackball adjustment tool.

The tool is stored in the keyboard base below the keyboard panel. To adjust the trackball movement, place both ends of the tool into the small holes in the black ring of the trackball housing. Turn clockwise to tighten and counterclockwise to loosen the trackball. The ball can be removed completely for cleaning.

Select Keys

Click

When this user guide tells you to “click” something on the screen, point at it and press [ ].

- The [ ] key can be used to select items from lists or menus on the screen.
- If the pointer points at a graphical control (such as the color box or one corner of it), clicking (pressing [ ]) selects the control so that the trackball can move it. Click [ ] again to deselect the control or selection. Usually this means that the trackball can move the pointer again.
- If the pointer points at an On/Off type on-screen control (such as **B Color**), pressing [ ] toggles the control off and on.

Click (long)

Some operations require you to point at something on the screen and then press (long) [ ]. See “Press (long)” on page 53. This is indicated in this user guide as *click (long)*.

+/- Key

+/- key

When the pointer points at a control on the screen, pressing [**+/-**] changes settings such as values or sizes. A single press increases or decreases values stepwise. A continuous press causes the value to keep changing. Pressing the right side of the key increases a value, pressing the left side decreases it. If the key is pressed for more than ½ second, the action starts repeating.

When the cursor points at	Pressing the +/- key
a softkey whose value can be changed	increases or decreases the value in the field.
a graphical control (such as the color box)	increases or decreases the size of the control.
an item on a list	moves the cursor up or down the list (so you can select a value) note: this does not apply to the setup menu

Table 3-2. Effects of pressing the+/- key.

For more details about using the on-screen controls, see “Controls on the Screen” on page 67.

Basic Keys

The Basic keys are arranged around the [ ] keys for easy access. These keys work in different scanning modes. For detailed information about using them, see the chapters about the various scanning modes.

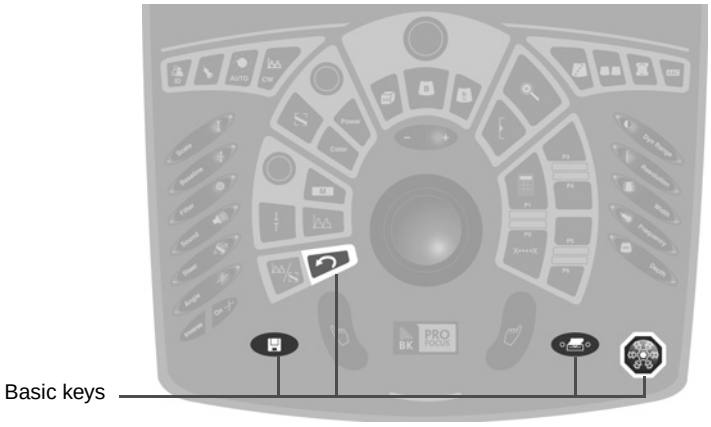


Figure 3-5. The Basic keys on the control panel.

Basic keys

Key	Name	Key Type	Action
[ ]	**Freeze**	Press	Freezes and unfreezes the image. See “Freezing the Image” on page 73.
[ ]	**Print**	Press	Starts one of the user-defined documentation functions. For more information, see “User-Defined Keys” on page 169.
[ ]	**Save**	Press	Starts one of the user-defined documentation functions. For more information, see “User-Defined Keys” on page 169.
[ ]	**Cancel**	Press	Cancels the present procedure or action. Works in all scanning modes.

Please note that some of the documentation functions are only available after a patient ID has been entered.

Table 3-3. Function of the Basic keys on the control panel.

B-Mode Keys

The B-mode keys are centered above the trackball. For detailed information about using them, see Chapter 7, “B-Mode – 2D Imaging”.

Figure 3-6. The B-mode keys on the control panel.

B-mode keys

Key	Name	Key Type	Action
[**Gain**]	**B Gain/Cine**	Turn	Adjusts the overall gain. If the image is frozen, turning activates the Cine scroll. For more information, See “Cine” on page 80.
[B]	**B-mode**	Press	If other modes than B are active, return to B-mode only. If only B-mode is active, return to last mode combination.
[3D]	**3D**	Press	Turns 3D imaging on (if the 3D Pro Package is installed). If 3D is already active, it steps through the different 3D states. A long press turns 3D imaging off.
[H]	**Harmonic**	Press	Turns harmonic imaging on and off.

Table 3-4. Function of the B-mode keys on the control panel.

B-Mode Adjustment Keys

The B-Mode Adjustment keys are grouped on the right side of the control panel. For detailed information about using them, see Chapter 7, “B-Mode – 2D Imaging”.

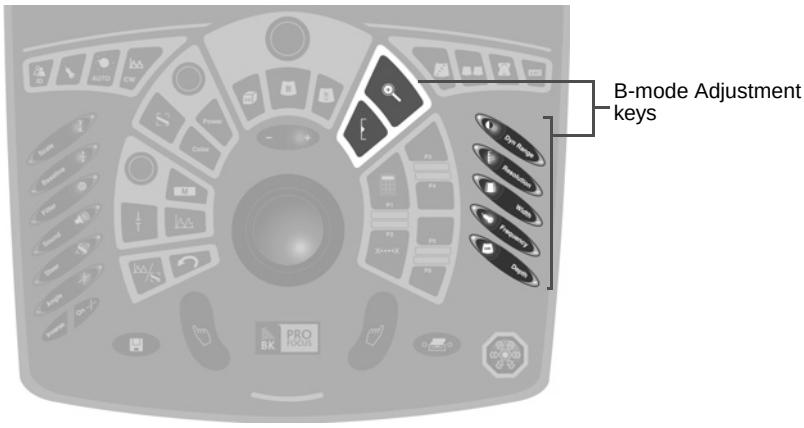


Figure 3-7. The B-mode Adjustment keys on the control panel.

B-mode Adjustment keys

Key	Name	Key Type	Action
[ ]	**Focus**	Press	Selects the **Focus** indicator on the screen so you can use the trackball and [**+/-**] keys to adjust the focus.See “Focus” on page 122.
[ ]	**Zoom**	Press	Turns on the zoom box. Press again to zoom in. A third press resets the zoom area. A long press turns zoom off if it is on.See “Zoom” on page 123.
[ ]	**Dynamic Range**	Rocker	Adjusts the B-mode dynamic range of the image.See “Dynamic Range (Contrast)” on page 123.
[ ]	**Resolution**	Rocker	Increases the resolution (decreases the scanning frame rate) or vice versa when you are scanning in B-mode or Color mode.
[ ]	**Width**	Rocker	Adjusts the sector width. See “Width” on page 120. Decreasing the width increases the frame rate.
[ ]	**Frequency**	Rocker	Adjusts the main (B-mode) center frequency when you are scanning in B-mode only. If you are scanning in Color mode, adjusts the center frequency for those modes. See “B-Mode Frequency – MFI” on page 127.
[ ]	**Depth**	Rocker	Changes the maximum depth (distance from the transducer) of tissue shown in the image. Pushing the + side *decreases* the depth (increases the magnification). See “Depth” on page 120.

Table 3-5. Function of the B-mode Adjustment keys on the control panel.

Power and Color Mode Keys

The Power and Color Mode keys are placed to the left above the trackball. For detailed information about using them, see the chapters about the various Doppler modes.

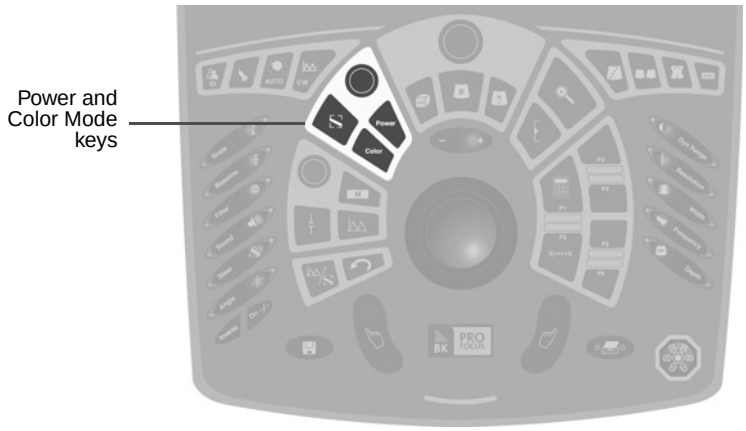


Figure 3-8. The Power and Color Mode keys on the control panel.

Power and Color mode keys

Key	Name	Key Type	Action
[**Gain**]	**Color/Power Gain**	Turn	Adjusts CFM (Color) gain if Color mode is active or Power gain if Power mode is active.
[**Power**]	**Power Mode**	Press	Turns Power mode (power Doppler) on and off. The trackball and [**+/-**] key are assigned to the color box when Power mode is turned on.
[**Color**]	**Color Mode**	Press	Turns Color mode (color Doppler, CFM) on and off. The trackball and [**+/-**] key are assigned to the color box when Color mode is turned on.
[ ]	**Color Box**	Press	Selects the color box (the same as clicking inside the color box on the screen). If the color box is already selected, pressing the [ ] key cancels the selection. The trackball and [**+/-**] key are assigned to the color box when color box is selected.

Table 3-6. Function of the Power and Color mode keys on the control panel.

Doppler and M-Mode Keys

The Doppler and M-Mode keys are placed to the left of the trackball. For detailed information about using them, see the chapters about the various scanning modes.

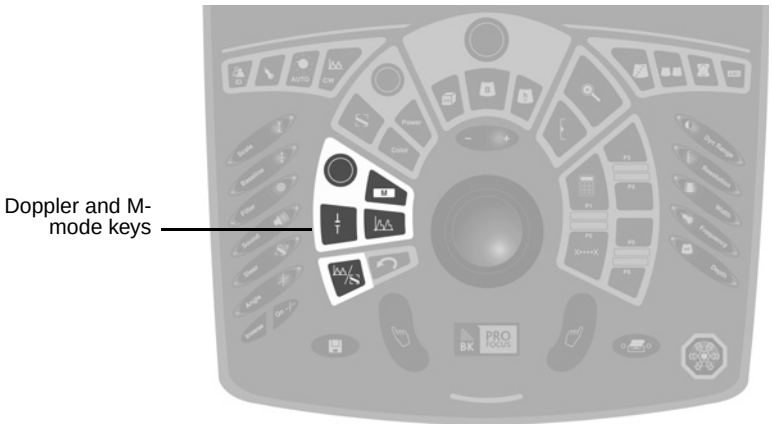


Figure 3-9. The Doppler and M-mode keys on the control panel.

Doppler and M-mode keys

Key	Name	Key Type	Action
[**Gain**]	**M/Doppler Gain**	Turn	Adjusts M gain if M-mode is active or Doppler gain if Doppler mode (spectral Doppler) is active.
[ ]	**Doppler Mode**	Press	Turns Doppler mode on and off. The trackball and [**+/-**] key are assigned to the Doppler gate when Doppler mode is turned on.
[M]	**M-Mode**	Press	Turns M-mode on and off. The trackball and [**+/-**] key are assigned to the M-line when M-mode is turned on.
[ ]	**D/M Cursor**	Press	In B-mode, turns on the Doppler gate so that you can position it before you activate Doppler mode. Press again to deselect the gate. A long press removes the gate. See “Doppler Indicator” on page 155.
[ ]	**Update**	Press	In combination modes, with one mode frozen, changes which mode is scanning and which is frozen. A long press unfreezes any frozen modes in the selected view. See “Update - Partial Freeze” on page 73.

Table 3-7. Function of the Doppler and M-mode keys on the control panel.

Doppler Adjustment Keys

The Doppler Adjustment keys are grouped on the left side of the control panel. For detailed information about using them, see the chapters about the various Doppler modes and M-mode.

Figure 3-10. The Doppler Adjustment keys on the control panel.

Doppler Adjustment keys

Key	Name	Key Type	Action
[Scale]	**Scale**	Rocker	Changes the scale/range/PRF in PW Doppler, Color mode and/or Power mode. If PW is active *and* Color mode or Power mode is active, the [**Scale**] key adjusts the PW mode. In this case, use the on-screen controls to change the scale for Color mode/Power mode.
[ ]	**Baseline**	Rocker	Moves the baseline of Doppler mode and/or Color mode. If both modes are active, moves only the Doppler mode spectrum baseline.
[ ]	**Wall Filter**	Rocker	Adjusts the wall filter. If both Doppler and Color modes are active, moves only the Doppler mode spectrum baseline
[ ]	**Sound**	Rocker	Adjusts the Doppler audio (speaker) volume and the video (speaker) volume during playback.
[ ]	**Steer**	Rocker	Changes the beam angle in Color mode, Power mode and PW Doppler. See “Steering” on page 155.
[ ]	**Angle**	Rocker	Changes the Doppler correction angle. See “Angle Correction” on page 156.
[On]	**Angle On**	Press	Turns the correction angle on or off.
[Inverse]	**Inverse**	Press	Inverts the spectrum (Doppler mode) or color scale (Color mode). If both Doppler mode and Color mode are active, inverts the spectrum only.

Table 3-8. Function of the Doppler Adjustment keys on the control panel.

User-Defined Keys

The user-defined keys are placed on the right side of the trackball. By default, the [P1] key is set up to open the **Calculations** menu, and the [P2] key is set up to open the **Measurements** menu.

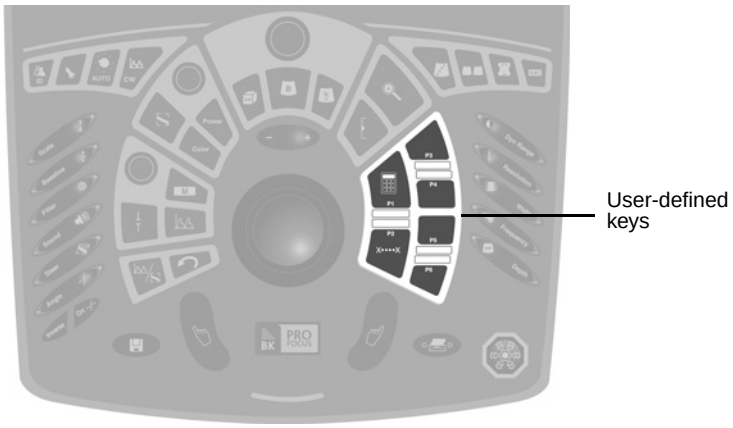


Figure 3-11. The user-defined keys on the control panel.

User-defined keys

Key	Name	Key Type	Action
[P1]	**Calculation**	Press	Opens the **Calculations** menu on the screen. See “Measurements and Calculations” on page 87 and “User-Defined Keys” on page 169.
[x••••xP2]	**Measure**	Press	Opens the **Measurement** menu on the screen. If the menu is already open, starts the measurement at the top of the first open measurement group. See “Measurements and Calculations” on page 87 and “User-Defined Keys” on page 169.
[P3] [P4] [P5] [P6]	**User-defined**	Press	The function of each of the 4 user-defined keys is defined within each Pro Package. Their function depends on which Pro Package is being used. For information about assigning functions to these keys, see “User-Defined Keys” on page 169.

Table 3-9. Function of the user-defined keys on the control panel.

Image Annotation Keys

The Image Annotation keys are grouped on the top right side of the control panel. For detailed information about using them, see Chapter 2, “Getting Started” and Chapter 4, “Working with the Image”.

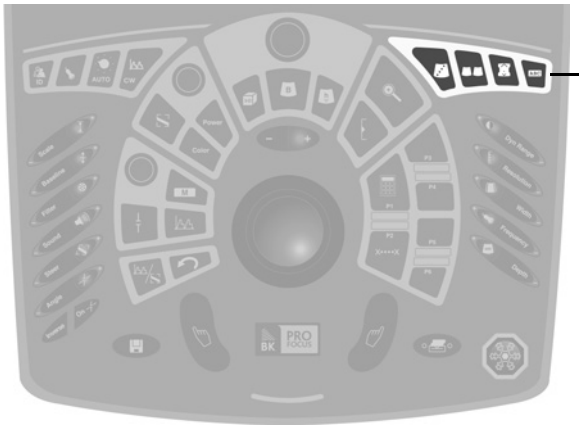


Figure 3-12. The Image Annotation keys on the control panel.

Image Annotation keys

Key	Name	Key Type	Action
[ ]	**Puncture**	Press	Turns a puncture or biopsy line on or off. See “Performing a Biopsy or Puncture Procedure (including Brachytherapy)” on page 43.
[ ]	**Split Screen**	Press	Splits the screen so two view are displayed. If the screen is already split, pressing shifts between which view is active. A long press turns split screen off if it is on. See “Split Screen” on page 74.
[ ]	**Bodymark**	Press	Opens the **Bodymark** window so you can place a bodymark on the image. Press to close the **Bodymark** window again. See “Using Bodymarks” on page 78.A long press removes bodymarks.
[ABC]	**Label**	Press	Opens the **Label** window so you can add text or arrows to the image. See “Placing Labels” on page 75.A long press removes all labels and arrows.

Table 3-10. Function of the Image Annotation keys on the control panel.

Miscellaneous Keys

The keys on the top left side of the control panel have varied functions.

Figure 3-13. The Miscellaneous keys on the control panel.

Miscella-neous keys

Key	Name	Key Type	Action
[ID]	**ID**	Press	Opens the **Patient** window for entering data about a new patient. For more information see “Setting up a New Patient” on page 36.
[Transducer]	**Transducer/ Pro Package**	Press	Opens the **Pro Package** menu on the screen so you can choose a transducer, a Pro Package or Diagnostic Setup. For more information See “Selecting a Pro Package or Diagnostic Setup” on page 42.
[Auto]	**Auto**	Press	Turns the Auto Adjust function on and off.
[CW]	**CW Doppler**	Press	Turns CW Doppler on and off. The trackball and [+/-] key are assigned to the CW Doppler gate when CW Doppler mode is turned on.

Table 3-11. Function of the Miscellaneous Control keys.

TGC Sliders

The 8 TGC sliders to the upper right of the keyboard are used to adjust the Time Gain Control at various depths in the image.

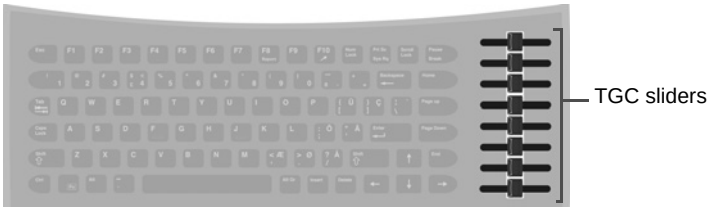


Figure 3-14. The TGC sliders on the keyboard panel.

Each slider controls 1/8th of the depth of the displayed scanned area. The top slider affects the top of the image and the bottom slider the bottom. (With 360° transducers, the top slider adjusts the part of the image that is most central – that is, closest to the transducer. The bottom slider adjusts the part of the image farthest from the transducer.)

Move the sliders to the right to increase gain. Move the sliders to the left to decrease gain.

Each slider is related to a part of the screen rather than a part of the tissue being scanned. Therefore, if you move, resize or invert the scan area, you may have to use the sliders to readjust the TGC in order to get the best image.

Keyboard

In addition to the control keys, the keyboard panel contains an alphanumeric keyboard for entering information into the system.

The [**F1**] to [**F10**] keys are user-definable keys. The [**F8**] and [**F10**] keys have default functions assigned:

F8 and F10

Key	Name	Default Function
[**F8**]	**F8**	Displays a report. A report is defined for each Pro Package. The content of the report will vary, depending on the Pro Package and the measurements you have made. For more information, see “Reports” on page 114.
[**F10**]	**F10**	Displays an arrow on the image and allows you to add text to the image. See “Placing Labels” on page 75.

Table 3-12. Default function of the F8 and F10 keys.

Controls on the Screen

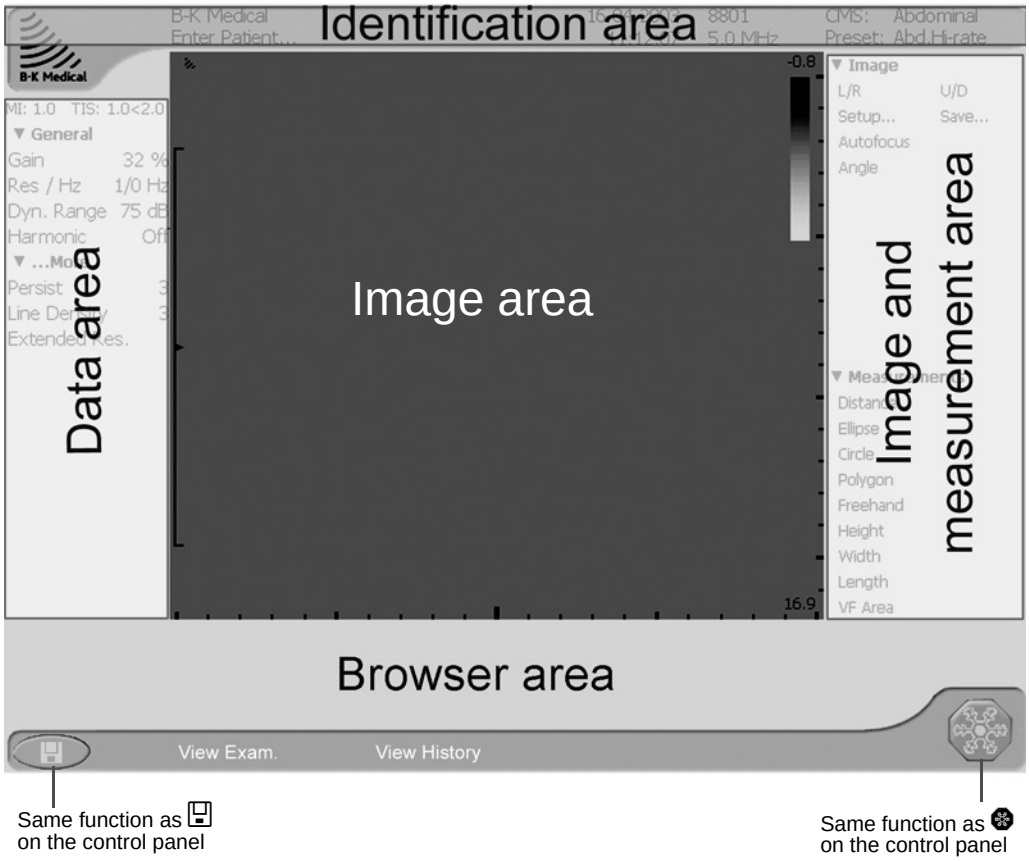


Figure 3-15. The parts of the display on the screen.

Image area

- The Ultrasound Image area is in the center. This area displays the current scanning and/or frozen views. Graphical on-screen controls such as the zoom box, color box and focus indicator are located in this area.

Identification area

- The Identification area is at the top.

  This contains identifying information about the hospital and patient, the date and time, the transducer type and scanning frequency (and scanning plane, for a biplane transducer), and the name of the Pro Package and Diagnostic Setup.

Data area

- The Data area is on the left side. It displays data that must be documented with the image. Information displayed in this area is automatically updated.

  The Data area has a data section at the top that contains the relevant settings for image parameters. It has a measurement section at the bottom. The measurement section displays the results of current measurements you have made.

Image Documentation area

The Image area, the Identification area and the Data area make up the Image Documentation area and will appear in documentation (except for the Pro Package and Diagnostic Setup names).

Image and Measurement area

- The Image and Measurement area is to the right. You may need to click **Image** to see the image tools or click **Measurements** to see the measurement tools. This area will not appear in documentation.

Browser area

- The Browser area is at the bottom. Small pictures (thumbnails) of the clips and images stored in the scanner are displayed across the bottom of the screen. This area will not appear in documentation.

Point and Click

Using the trackball and trackball keys to interact with the controls on the screen is intuitive and easy. In this user guide, certain terms are used consistently to tell you what to do.

Terminology

Point at

Use the trackball to move the pointer to a control. When a control is *pointed at*, you can adjust it with the [**+/-**] key but you cannot move it. To move a graphical control, you must select it.

Click (select)

Point at an on-screen control and press [ ]. When a control is *selected*, moving the trackball resizes or moves it. (Pressing [ ] again cancels the selection, making it possible to use the trackball to move the pointer.)

Drag

Use the trackball to move a cursor or graphical control.

When an on-screen control has the color	It is	You can
White	Available	Point at it or select it.
Orange	Pointed at	Adjust it with [**+/-**]. Select it.
Blue	Selected	Move it with the trackball. Adjust it with the pointer or [**+/-**]
Gray	Unavailable	(No action possible).

Table 3-13. Color coding of controls on the screen.

For some actions, you do not need to click. You can just point and press the [**+/-**] key (see the following section).

Moving

To move a graphical control on the screen:

1. Click the control to select it.
2. Drag the selected control to the position you want.
3. Click to release the trackball for other uses.

Changing size

To resize a graphical control on the screen:

- Select or point at the control and press [+/-].

or

1. Click a boundary of the control (such as a corner of a box or a boundary of the focus indicator) to select it.
2. Drag the selected control part until the control is the size you want.
3. Click to release the trackball for other uses.

Softkeys

The screen contains many softkeys for functions whose value can be adjusted or changed. These softkeys appear as words or abbreviations on the screen.

Softkeys with values

To select a value for a softkey:

1. Click the softkey.

   A list of possible values appears.
2. Click the value you want.

You can also use [+/-] to scroll up and down in the list and then press [ ].

> **NOTE:** *Not all softkeys may be visible. Click the expand symbol to see the all items in a menu. To change the setup for how menus appear, see Chapter 13, "Setting Up and Customizing Your System".*

Slider softkeys

Some softkeys have a slider that you move with the trackball.

On/Off softkeys

Some softkeys have only two values, On and Off.

To change the setting of an On/Off softkey:

- Click it.

or

- Point at it and press [+/-] to toggle the value.

Small green light

A small green light next to the key indicates that it is set to On.

Foot Switch

The optional foot switch has 2 pedals. You can assign a function to each pedal, and the same pedal can have different functions for different Pro Packages. For information about assigning functions to the pedals, see"User-Defined Keys" on page 169.

To use the foot switch:

- Press the appropriate pedal.

  NOTE: *Releasing the pedal does not operate or reverse the function.*

Palm Control Unit (PCU)

You can use the optional PCU UA2410 to operate the scanner at a distance from the keyboard panel. The PCU plugs into a socket on the back of the scanner. See page 45 for important information about waiting 12 seconds before using the PCU and about checking the part number.

Figure 3-16. The PCU.

Some of the PCU controls work like particular keys on the control panel. Some work differently. Table 3-14 contains an overview of the PCU controls and which control panel keys they relate to.

PCU Control	Control Panel Key + Name	Function
		Activates Picture in Picture (PiP). (PiP is an optional feature.) Displays an external image and an ultrasound image simultaneously. One image is large, one is small. Short press toggles through 3 views: small external image, small ultrasound image, external image only. Long press turns off PiP (returns to ultrasound image only). See “Toggling through the PiP States” on page 85.
MHz	[**Frequency**] Frequency	If Power mode or Color mode is active, press to toggle through the Power mode or Color mode frequencies for the selected transducer. If B-mode only is active, press to toggle through the B-mode frequencies. A long press opens the Pro Package Menu window (see page 43), so you can select a different transducer, Pro Package or Diagnostic Setup.
	[ ] Puncture	See “Puncture” on page 64.
P1, P2	[**P1**], [**P2**] User-defined	User-defined keys.To assign functions to these keys, see page 170.
X••••X	[X••••X] Measure	User-defined keys. See “Measure” on page 63.
	[ ] Depth	See “Depth” on page 58.
	[**Gain**] B Gain/Cine	B Gain only. See “B Gain/Cine” on page 57.
	[ ] Freeze	Freezes and unfreezes the image. See “Freezing the Image” on page 73. A long press starts one of the user-defined documentation functions.
	[ ] Select	See “Select Keys” on page 55.
- and +	[**+/-**] +/-	See “+/- Key” on page 55.

PCU Control	Control Panel Key + Name	Function
Mouse Stick	**Trackball**	See “Trackball with Select Keys” on page 54. If you push the mouse stick farther from the center position, the cursor moves faster.
	[Doppler Mode]	See “Doppler Mode” on page 60. A long press on this key steps through the partial freeze states.
	[Scale]	See “Scale” on page 62.
C-Gain	[**Gain**] Color/Power Gain	Doppler gain. If Doppler mode is active and not partially frozen, press to modify Doppler gain.
	[**Gain**] M/Doppler Gain	If Doppler mode is not active, modifies Color gain (if Color mode is active), and modifies Power gain (if Power mode is active).
Color	[**Power**] Power Mode	Toggles Power or Color mode, whichever was the last used, on and off. A long press toggles between Color and Power modes.
	[**Color**] Color Mode	

Table 3-14. Controls on the PCU.

Transducers

Control button

Some transducers have a control button that you can press to *Start* or *Stop* scanning (freeze frame).

Long press

You can set up your system so that a long press (more than one second) starts one of the user-defined documentation functions, such as capturing an image.

If the transducer has more than one control button, you can set up a user-defined long press function for each control button.

Each time the control button is pressed, a ‘beep’ is emitted.

Chapter 4
Working with the Image

To adjust and work with the image (for example, to resize the image or to make a measurement), you can usually use the trackball keys to point and click and drag. In some cases (for example, to freeze the image), you can use special keys on the control panel. For more information about using the trackball and other keys, please see Chapter 3, “The User Interface”.

Image Orientation

You can change the horizontal or vertical orientation of a 2D image. The view must be scanning when you change orientation.

To change Left/Right or Up/Down orientation:

- Click **L/R** or **U/D** under **Image** on the right side of the screen.

  The images of all modes in the selected view are inverted horizontally or vertically.

  NOTE: *When you change image orientation, you may need to adjust the TGC settings for the B-mode image. See “TGC” on page 121*

Freezing the Image

To freeze the image, press [❁] or click **Freeze**. (You can also use the button on the transducer itself – see the transducer user guide for information about this.)

All images on the screen are frozen.

If you press [❁] again, the image returns to its previous state.

NOTE: *When you freeze the image, the date and time displayed on the screen are also frozen, so the time displayed on a printed image is the time the image was frozen, not the time it was printed.*

Update - Partial Freeze

Partial freeze is something you can do only when you are scanning in Doppler mode as well as one or more 2D modes (B-mode, color and power). Partial freeze lets you freeze only the Doppler image or only the 2D-mode image.

To start partial freeze:

- Press [⁄].

The partial freeze state starts with 2D-modes frozen and Doppler mode scanning.

When partial freeze is turned on, pressing [ ] toggles the display between the 2 states:

- Doppler mode frozen; 2D-modes scanning.
- 2D-modes frozen; Doppler mode scanning.

To end partial freeze:

- Press (long) [ ].

  Any frozen modes in the selected view start scanning.

Split Screen

You can split the screen horizontally or vertically to display 2 views side by side or one over the other. If simultaneous scanning is turned on, both views can be scanning.

To split the screen:

- Press [ ].

  The screen is split to display 2 scan images.

  If you are using a single-plane transducer, the 2 views contain the same scanning view.

  If you are using a biplane transducer, each view displays the image from one scanning plane.

To select one of the views:

- Click in the view you want to select.

or

- Press [ ] to select the view that is not currently selected.

To remove the split:

- Press (long) [ ].

  The currently selected view is resized to fill the screen.

Simultaneous Scanning

The 2 views in a split screen can both be scanning simultaneously; in this case, freezing and unfreezing affect both images.

To turn simultaneous on and off:

- Click **Simultan** on the right side of the screen.

Color or power in one view only

NOTE: *In simultaneous split-screen scanning, only one of the views can contain color or power mode. Thus if one view has B+Color or B+Power, the other view contains only a B-mode image.*

Labelling Parts of the Image

You can place text labels and arrows anywhere on the ultrasound image. You can select a label from a catalog or type a new one. Label catalogs can be customized in many ways. See “Label Setup” on page 191.

NOTE: *If you move the image or change its scale, an arrow or label with arrow will stay pointing at the same an anatomical structure. (That is, it will move with the image.) A label with no arrow will stay on the same part of the screen and not move with the image.*

You can add more than one label to an image.

Placing Labels

Your system can be set up so that you can type labels directly on the image or select a label from the label catalog. See “Label Setup” on page 191.

To label the image:

- Type the label.

You can also use the **Label** window.

Using the Label Window

To open the Label window:

- Press [ABC] **or** [**F9**]**.**

  The **Label** window appears, displaying the label catalog that you have used most recently (for the Pro Package you are using). The label that you used most recently is displayed in the **Edit** field.

  Use the drop-down menu at the top of the window to select other catalogs.

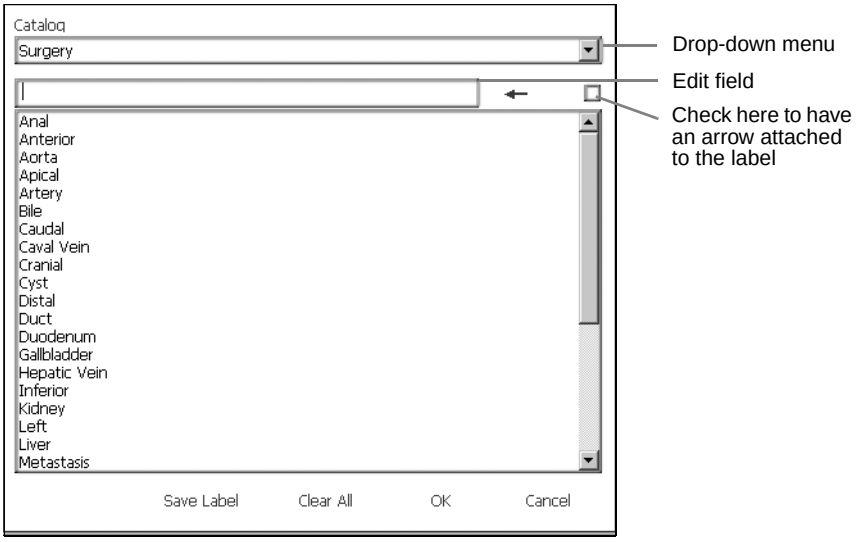


Figure 4-1. The Label window with the Surgery catalog displayed.

To use a label from the Label window:

1. To use the label in the **Edit** field, go to Step 2.

   To use one of the other labels in the catalog, click the label text you want.

   To edit the label in the **Edit** field or use a label that is not in the catalog, type in the field.

   To attach an arrow to the label, check the box next to the arrow. (See Fig 4-1.)

2. When you have selected the label you want and decided whether it should have an arrow attached, press [**Enter**] or click OK.

   The **Label** menu disappears and the label itself appears on the image in the default position.

Arrows

You can place arrows anywhere on the image to indicate a region of particular interest. You label the arrow.

To place an arrow on the image:

1. Press [**F10**].

   An arrow appears.

2. If you want to label the arrow, type the label.

   The label appears next to the tail of the arrow.

3. Drag the arrow to the required position and click**.**

To change the direction of an arrow or move it:

1. Click the arrow to select it.

2 Press [+/-] to change the orientation of the arrow.

The tail of the arrow moves in a clockwise direction with each press. If the arrow is labelled, the label moves with the tail of the arrow.

3 Click.

Moving Labels and Arrows

To move a label or arrow that you have already positioned, click it and drag it to the new position. Click again when the label or arrow is where you want it.

Creating and Editing Labels

You can create new labels and edit the text of existing ones.

Adding a label

To add a label to the catalog:

1 If the label menu is not already displayed, press [F9].

2 Type the new label text in the **Edit** field.

3 Click **Save Label**.

You can also use the **Label Setup** window to create or delete labels in a catalog. See "Label Setup" on page 191.

Editing a label on the image

To edit a label on the image:

1 Click the label on the image to select it.

2 Press [F9].

The Label menu appears with the text of the selected label in the **Edit** field.

3 Edit the label text.

4 To save the edited label to the list, click **Save Label**.

5 To change the label on the image to the new, edited name, click **OK**.

You can also click the label and edit it directly on the image.

Removing Labels and Arrows

To remove a label or arrow from the image:

- Click (long) the label or arrow you want to remove. (This means "Press (long) [☜] while pointing at the label.")

To remove all labels from the image:

- Press (long) [ABC].

or

1 Press [F9].

The **Label** menu appears.

2 Click **Clear All**.

Using Bodymarks

Bodymarks are small bitmaps depicting parts of the body. You can place a bodymark anywhere on the ultrasound image.

You can set up a user-defined key to place a frequently-used bodymark. See “Assigning User-Defined Keys” on page 170.

A scanning plane indicator can be placed on the bodymark in order to show the scanning position.

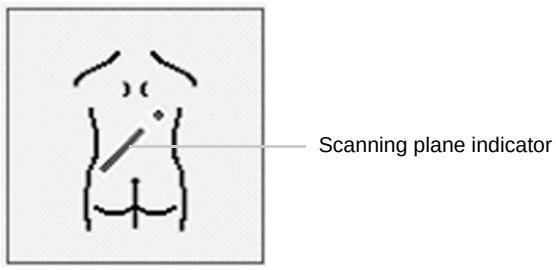


Figure 4-2. Bodymark with scanning plane indicator.

Scanning plane indicator

The scanning plane indicator consists of a long bar and small square. The orientation of the bar indicates the orientation of the probe on the body, and the square indicates the part of the probe that corresponds to the upper left of the scanned image on the screen.

Bodymarks are organized in catalogs. You select the one you want from one of the catalogs. Bodymark catalogs can be customized in many ways. See “Bodymark Setup” on page 189.

Adding a Bodymark

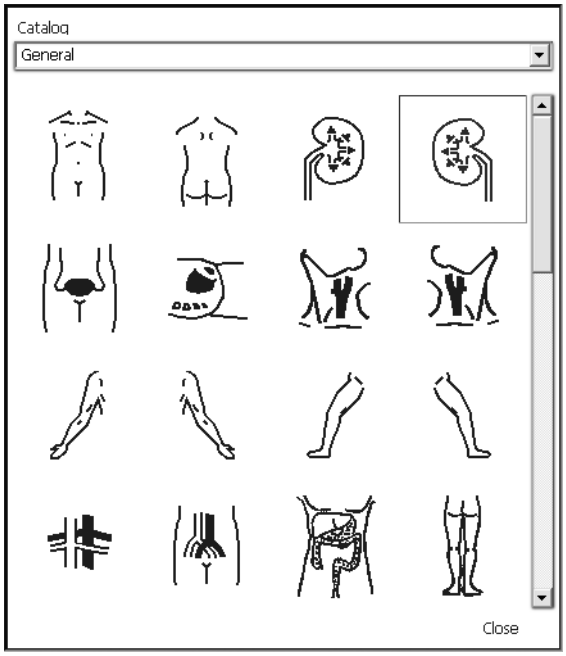


Figure 4-3. The Bodymark window with the General catalog displayed.

To place a bodymark on the image:

1 Press [ ].

The **Bodymark** window appears, displaying the most-recently-used bodymark catalog for the Pro Package you are using.

Use the drop-down menu at the top of the window to select other catalogs.

2 Click the bodymark you want.

The **Bodymark** window closes, and the bodymark appears on the screen, with a scanning plane indicator. You can rotate or drag the scanning plane indicator to a different position.

Moving a Bodymark

To move a bodymark, click it, drag it to the position you want, and click again.

Adjusting the Scanning Plane Indicator

To adjust the scanning plane indicator, click it. You can then:

- drag it with the trackball
- rotate it with [**+/-**]

Click again when the scanning plane indicator is the way you want it.

Replacing a Bodymark

To replace an existing bodymark with a different one, click the bodymark on the screen and select a new bodymark from the **Bodymark** window that appears.

Setting a Default Position for Bodymarks

For each Pro Package, you can set a default position for bodymarks. Whenever you place a bodymark, it appears in the default position on the image. (You can move it.) The position and angle of the scanning plane indicator are also saved as part of the default.

To set a default position for the bodymark:

1. On the image, move the bodymark to the position you want.
2. Adjust the position and angle of the scanning plane indicator on the bodymark.
3. Click the bodymark.

   The **Bodymark** window appears.
4. Click **Save Position**.

   The bodymark position and the scanning plane indicator position and angle are all saved as default for the Pro Package. Whenever you place a bodymark on an image while using the current Pro Package, it will appear in this default position. You can move it, of course.

Removing a Bodymark

To remove a bodymark from the screen:

- Point at the bodymark and click (long).

or

- Press (long) [⌂].

Unless you delete it or replace it with a new one, a bodymark will remain on the screen until you change Pro Packages or begin to scan a new patient.

Adding New Bodymarks

You can import your own images to the bodymark catalog. See “Importing Bodymarks from a File to a Catalog” on page 190. The bodymarks are 100 x 100 pixel black and white bitmaps. Larger images will be scaled.

Cine

Cine (image review) lets you review a series of the most recently recorded B-mode, B+Color mode, B+M-mode or B+Doppler mode images. You can scroll backward or forward through the series.

Scanned images are constantly being saved and stored for review. When the storage capacity is reached, the oldest images are discarded as new ones are stored. The number of images that can be stored for review varies, depending on such factors as image resolution and size.

Images viewed with the CINE function must be comparable. Therefore, changing certain parameters that affect the image will cause already-stored images to be discarded. If this happens, there will not be a full set of images to be reviewed until the storage has had time to fill again.

You can change some of the settings for the **Cine** function. For information about changing Cine functions see “Clip Storage and Cine Setup” on page 173.

To turn Cine on and off:

- Press [ ] to stop scanning.

  A vertical cursor line appears and **Cine** appears below **Image** on the right side of the screen.

  The current image (**Frame**) number is displayed in the **Cine** menu.

Image (frame) numbers

NOTE: *Higher numbers are farther in the past. The image scanned most recently is number 1.*

To review the images:

- Click **Frame** under **Cine** and drag the slider to select the frame number.

or

- Select the cursor by clicking on it and press [**+/-**], or drag to scroll through the images.

  NOTE: + *goes to the next image (lower image number) and* **-** *goes to the previous image (higher image number).*

Using Cine in M-Mode or Doppler Mode

When cine is activated while scanning in M-mode or Doppler mode, a vertical cine cursor is displayed overlaying the Doppler or M-mode image.

The B-mode image displayed is always the one that corresponds to the position of the Doppler or M-mode cursor. The image (frame) number in the **Cine** indicator corresponds to the B-mode image.

To make measurements on a cine image or record it:

1. When the desired image is displayed, press [ ] to release the trackball from controlling the image review.
2. Make measurements on the image or record it in the usual way.

Cine Play

You can also review the images as a movie using **Cine Play**.

To review the images using Cine Play:

- Click **Cine Play** under **Cine** on the right side of the screen.

Cine Loop

During **Cine Play** the image with the highest frame number (oldest) is displayed first, followed by images with decreasing frame number (newer). After the newest image has been displayed, **Cine Play** will begin again with the highest frame number and repeat the sequence.

Start and Stop Markers

The **Start** and **Stop** marker positions are displayed under **Cine** (See Fig 4-4).

You can choose the range of images to be displayed in **Cine Play** by setting the Start and Stop markers in the **Cine** menu.

To Set a Start or Stop Marker:

1. Click on **Frame**.
2. Drag the **Frame** slider to select the required frame number.
3. Click the marker you want to set.

   NOTE: *The image chosen for the Start marker must be older (the Frame number must be higher) than the image chosen for the Stop marker.*

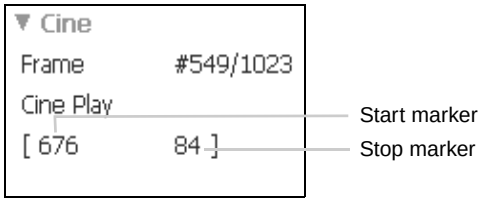


Figure 4-4. Cine Menu with Start and Stop markers.

Playback Speed

You can adjust the speed at which images are reviewed.

To adjust the playback speed:

- Click **Speed** and drag the slider to the required value.

  The available values range from 0 (slowest) to 100 (fastest).

The Video Window and Picture in Picture (PiP)

You can display a video image on the screen. The video image can come directly from a camera (endoscope, for example), or it can be played back from a video recorder.

Picture in Picture (PiP), which can be purchased as an option for the Pro Focus, lets you view two types of images at the same time, on the same screen: an ultrasound image and a video image.

To run the PiP software, you must have a license from B-K Medical. For information about activating the PiP option, see “Licenses” on page 196. For more information about purchasing the PiP option, see Appendix C, “Specifications”.

Using the Video Window

When you display a video image on the screen (and are not using PiP), the video image appears in a window that covers the ultrasound image and the on-screen controls to the left of the image. It also covers the patient ID and some other information at the top of the screen. This large window is called the *video window.*

Video window

To activate the video window:

- Click **Video** under **Image** on the right side of the screen.

or

- If the PiP window is open but the main image is an ultrasound image, press on the PCU to toggle the state (see Fig 4-6 on page 86).

To close the video window:

- Click **Video** under **Image** on the right side of the screen.

or

- Press (long) on the PCU.

The video window covers the ultrasound image. Therefore you cannot use any keys or on-screen controls that affect the ultrasound image when the video window is open.

NOTE: *You cannot move or resize the video window.*

You can use the COPY and FREEZE functions.

Unfreeze

If you unfreeze the ultrasound image, the video window closes if PiP is not turned on.

Changing audio volume

To change the audio volume of the video signal, press [**Sound**].

Changing the Video Setup

The video setup determines how the video image looks. You can change the video setup while a video image is displayed in the video or PiP window. You use the **Video Setup** window to specify the video source (the connector on the back of the scanner and the equipment that is attached to it). The video format (PAL or NTSC) that is set in the **General Setup** window also affects the video input. See “Video Format” on page 172.

To change the video setup:

- Click **Video Setup** under **Image** on the right side of the screen. (**Video** or **PIP** must be selected.)

  The Video Setup window appears.

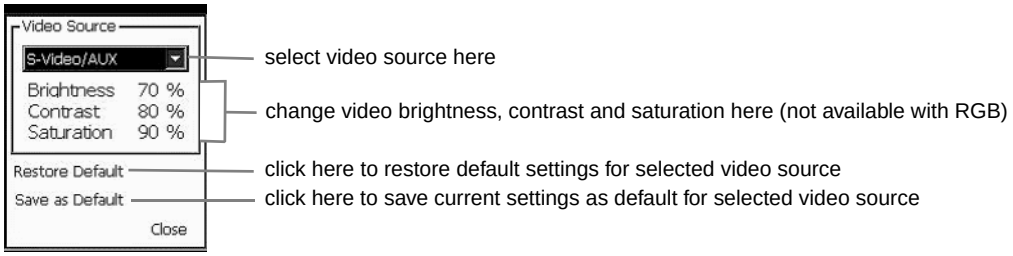

Video Source
S-Video/AUX
Brightness 70 %
Contrast 80 %
Saturation 90 %
Restore Default
Save as Default
Close
select video source here
change video brightness, contrast and saturation here (not available with RGB)
click here to restore default settings for selected video source
click here to save current settings as default for selected video source

Figure 4-5. The Video Setup window.

Table 4-1 explains the video source options.

Video Source	Connector	Equipment Attached (Example)
S-Video/Camera		S-VHS video camera.
S-Video/VCR		S-VHS VCR
S-Video/AUX		A different S-VHS video camera.
Composite/Camera		Composite video camera.
Composite/VCR		Composite VCR
Composite/AUX		A different composite video camera.
RGB		RGBS video camera

Table 4-1. The video source options in the Video Setup window.

> **NOTE:** *The equipment names (Camera, VCR, AUX) are just labels so that you can save setups for different equipment. If you plan to use three different composite video cameras, then you can use one of the first three options in the table for each camera.*

See page 323 for the location of the connectors on the back of the scanner.

Using PiP

PiP window

When you use PiP (Picture in Picture), there are two image windows on the screen – one large and one small. The *PiP window* is the smaller window. If the main image on the screen is an ultrasound image, the PiP window contains an external video image. If the main image is a video image, the PiP window contains an ultrasound image.

Do not cover patient ID or other important information

WARNING When you use Picture in Picture, do not cover critical information (such as TI or MI) on the screen. Make sure that all important information – including the patient ID – will appear if you print or save the ultrasound image.

If the PiP window is outside the image documentation area (see page 67), it will not appear when you print the image. You must make sure that the PiP window is in a suitable position for your purposes.

To display the PiP window:

- Click **PIP** under **Image** on the right side of the screen.

or

- Press on the PCU.

The contents of the PiP window when it opens depends on whether the video window is active (open) when you turn on PiP.

Video Window	PiP Window Contents
Not Active	Video from external video signal
Active	Ultrasound image

Table 4-2. Contents of the PiP window when it opens.

To turn off PiP:

- Click **PIP** under **Image** on the right side of the screen.

or

- Press (long) on the PCU.

Toggling through the PiP States

If the video window is not active, pressing turns on PiP, with a video image in the smaller window.

A second press transposes the images so that the video image is in the big window and the ultrasound image is in the smaller PiP window.

A third press turns off PiP but leaves the video image on the screen.

A fourth press goes back to the initial PiP state, with the ultrasound image big and the video image in the PiP window.

Further presses toggle around the three states that include a video image on the screen. A long press on returns you to normal scanning with no video image on the screen.

Fig 4-6 illustrates the effect of successive presses.

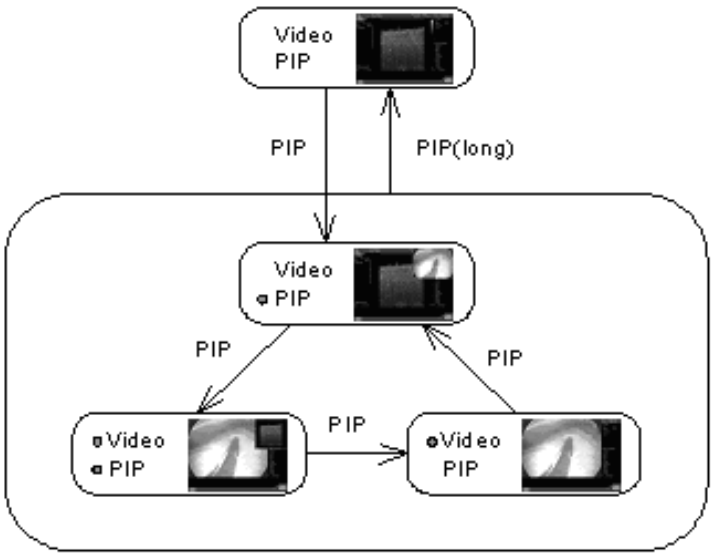


Figure 4-6. Effect of using the PiP key on the PCU to toggle through various PiP states.

Available controls

When the PiP window contains an ultrasound image, most ultrasound controls are disabled. You can only use GAIN, TGC, FREEZE and COPY functions.

Adjusting the PiP window

The PiP window can be placed anywhere on the screen. It can have 3 possible sizes.

To reposition the PiP window:

1. Click inside the window.
2. Drag the frame to the position you want.
3. Click.

   The PiP window moves to the new frame position.

If you decide you do not want to move the window, press [Esc] or [↶]. The frame is not selected anymore.

To change the size of the PiP window:

- Move the cursor so that it is inside the window and press [+/-] to increase or decrease the window size.

or

- Click inside the PiP window and then press [+/-] to increase or decrease the window frame size. When you are finished, the PiP window changes size to fit the frame.

Chapter 5
Making Measurements

Measurements and Calculations

You can use a variety of tools to measure aspects of the ultrasound image (and thus the underlying tissue). These measurements can be used for various calculations.

Accuracy

For information about the accuracy of different types of measurements, see *General Transducer Information* (BB 0555).

Each Pro Package contains the measuring tools that you will need for the calculations that the package contains. You can find descriptions of all the calculations in the Pro Package chapters.

You can also define customized measurements that you want to use. See "User-Defined Measurements" on page 178.

To view the list of measurements:

- Freeze the image.

  The names of all available measurements are displayed under **Measurements** to the right of the image.

  If the list is not visible, click **Measurements** to expand the list.

  To see more measurements, scroll with the trackball.

Making a Measurement – General Procedure

The sections following this one contain detailed descriptions for using the various measuring tools.

Image must be frozen

NOTE: *The image must be frozen.*

To make a measurement:

1. Click the name of the measurement.

   If you can use more than one measuring tool to make the measurement, a small triangle ▼ appears to the right of the measurement. Click the ▼ to expand the list. Click the measuring tool you want to use.

   A marker appears on the image.

2. Drag the marker to the position you want. Click.

   If the measurement requires 2 markers, another one appears.

3. Drag the second marker to the position you want. Click.

4 Repeat this until you have positioned all the markers for the measurement.

NOTE: *The look of the markers themselves and of any lines that connect them depend on what you are measuring.*

Measurement results displayed

Results The results of the measurement are displayed (continuously updated) at the bottom of the data area to the left of the image.

Depth While you are positioning the first marker for a distance measurement in a B-mode or Color mode image, the displayed measurement is the depth of the marker (distance from the marker to the transducer surface along the scan line). When a second marker is positioned, the depth is replaced by the appropriate measurement result.

Clearing a Measurement

There are 3 ways to clear a measurement and any current calculations that use the measurement.

To clear a measurement, do one of the following:

- Point at the marker and press (long) [ ].
- Point at the measurement result and press (long) [ ].
- Press [**Esc**] while the measurement is selected on the screen.

Clearing All Measurements

You can clear all the measurements on the screen at once.

To clear all measurements:

- Press (long) [x••••x].

B-Mode and Color Mode Measuring Tools

Distance Measuring Tool

Measuring a distance

Two markers can be positioned to measure a distance – the length or width of a structure, for example. When the first marker is positioned, a second one appears for you to position.

NOTE: *Pressing* [x••••x] *starts a distance measurement.*

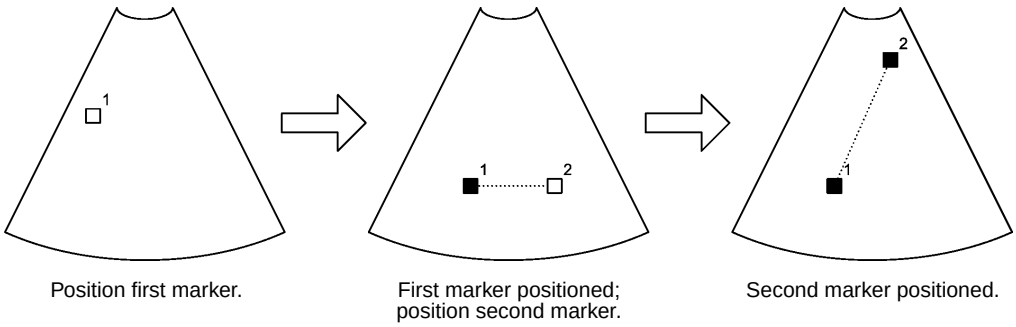


Figure 5-1. Positioning 2 markers on a B-mode or Color mode image.

NOTE: *The small numbers in the pictures (1,2) indicate the order in which the markers appear. The numbers do not appear like this on the screen.*

Repositioning a distance marker

To move a marker after they have all been positioned:

1. Click the marker.
2. Drag it to the new position.
3. Click.

Perpendicular Distances

Measuring distances at right angles

Sometimes it is important for one distance to be measured perpendicular (at right angles) to another distance. In this case, a small square appears at the intersection point when the two measurement lines are perpendicular to each other.

Angle Measuring Tool

On a B-mode or Color mode image, you can measure 1 angle or 2 angles. The angle measuring tool works slightly differently from the other measuring tools. The numbers in the instructions below refer to the numbers on the markers in Fig 5-2.

To measure an angle:

1. Click Angle.

   A marker appears.
2. Position the marker and click.

   A second marker appears, with a line connecting the two markers.
3. Position marker #2 to change the angle of the line. Click.

   A third marker appears.
4. Position marker #3 and click.

   A fourth marker appears, with a line connecting it to marker #3.
5. Position marker #4 to change the angle of the line. Click.

   Angle **alpha** between the two lines is indicated on the image and the size of the angle appears as a measurement to the left of the image.

If you have chosen to measure 2 angles, additional markers appear for you to measure another angle (**beta**) with the first line.

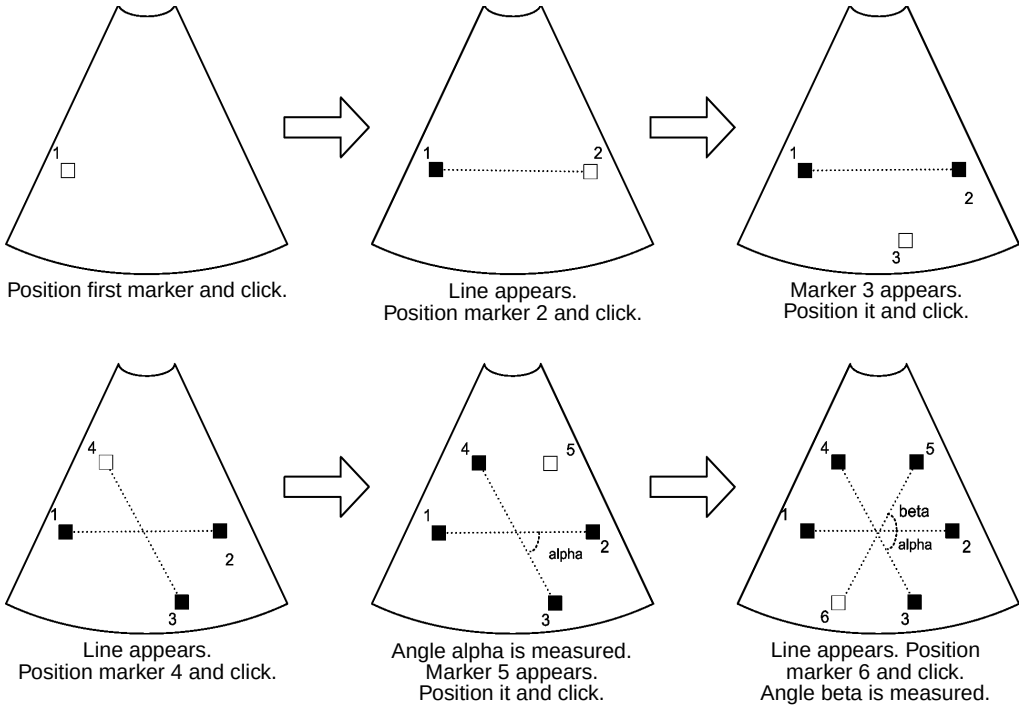


Figure 5-2. Using the angle measuring tool to measure two angles.

If you just click and do not move any markers, the default angles are 60º.

To change the angle measurement after all the lines are positioned:

- Click any marker and move it to change the length or orientation of one of the lines.

  NOTE: *If you click somewhere on the measuring tool that is not on a particular marker, moving the trackball moves marker #1.*

Circle Measuring Tool

On a B-mode or Color mode image, you can position 2 markers to measure a circle. Position the markers in the usual way. As you move the second marker, the circle is continuously redrawn on the screen.

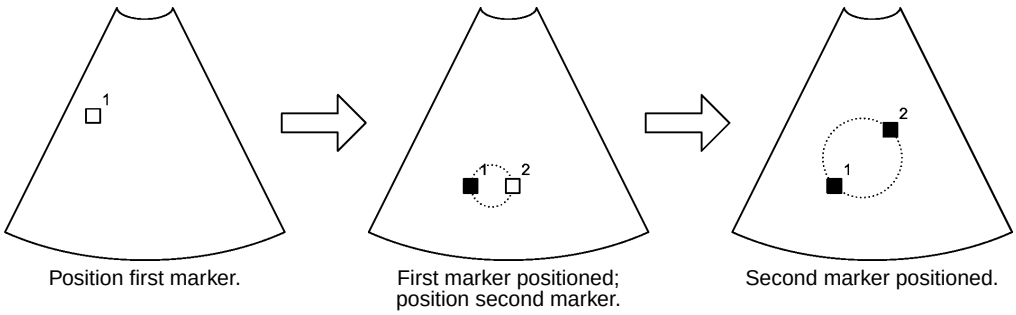


Figure 5-3. Using the circle measuring tool.

After the markers have been positioned, you can move any of them by clicking and dragging to a new location. Click again.

Repositioning a circle marker

To change the location or size of the circle:

1. Click one of the markers
2. Reposition the marker.
3. Repeat with the other marker, if necessary.

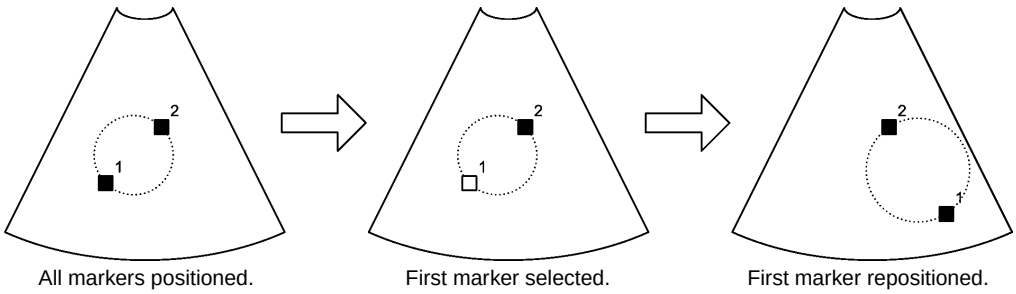


Figure 5-4. Repositioning one of the circle markers.

To move the entire circle without changing its size:

1. Click inside or on the circle.
2. Drag it.
3. Click again.

Moving a circle

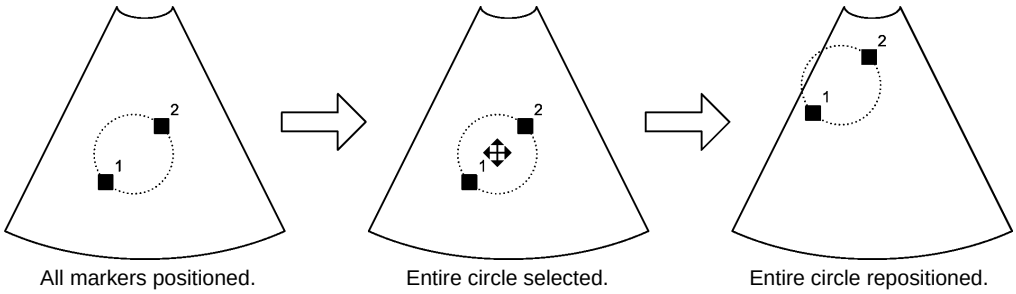


Figure 5-5. Moving a circle you have drawn.

Ellipse Measuring Tool

On a B-mode or Color mode image, you can use three markers to measure an ellipse. Position the markers in the usual way. The first 2 markers determine a line that is used as the axis of rotation if you use the ellipse to measure volume. The third marker is always equidistant from the first 2. Moving it makes the ellipse broader or narrower. As you move the third marker, the ellipse is continuously redrawn on the screen.

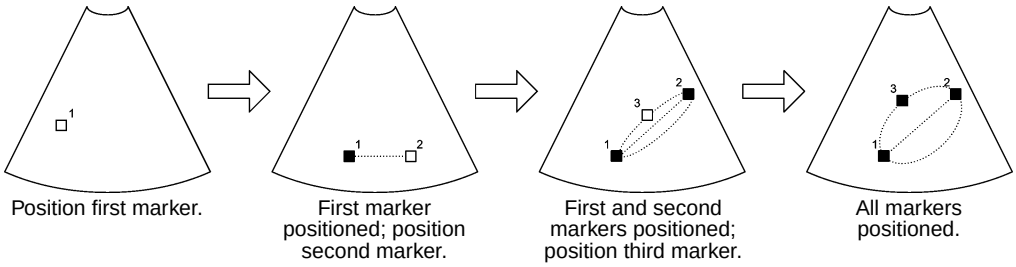

Position first marker.
First marker positioned; position second marker.
First and second markers positioned; position third marker.
All markers positioned.

Figure 5-6. Drawing an ellipse.

Repositioning an ellipse marker

After the markers have been positioned, you can move any of them by clicking and dragging to a new location. Click again.

NOTE: *Moving marker 1 or 2 in an ellipse will automatically move marker 3.*

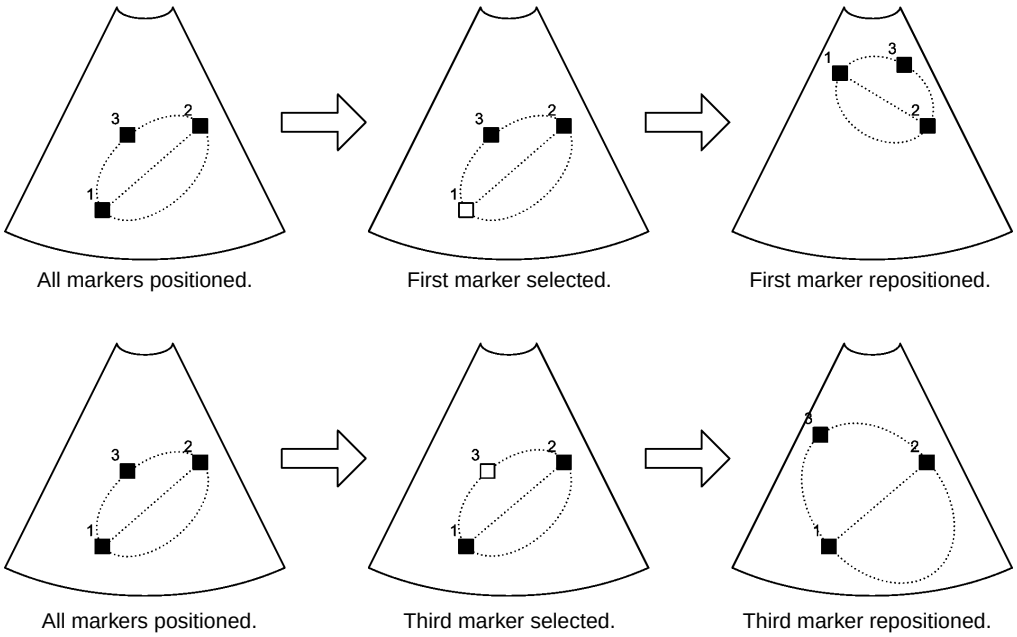


Figure 5-7. Repositioning markers in an ellipse you have drawn.

To move the entire ellipse without changing its size or orientation:

1. Click inside or on the ellipse.
2. Drag it.

3 Click again.

All of the ellipse does not have to lie within the ultrasound image.

Moving an ellipse

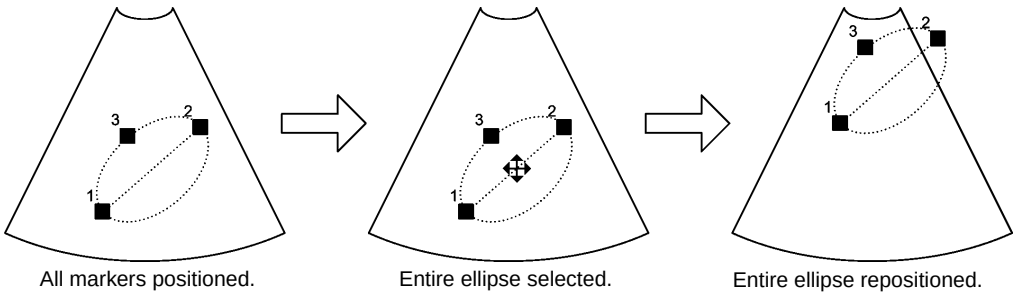


Figure 5-8. Moving an ellipse.

Polygon Measuring Tool

On a B-mode or Color mode image, you can position a number of markers to define the outline of a polygon. Position the markers in the usual way. After you position one and click it, a new marker appears. A dotted line connecting it to the previously positioned marker is continuously redrawn as you drag the new maker and click it to position it.

To delete the marker you have just positioned:

- Press **-** on the [+/-] key.

To undo the deletion:

- Press **+**.

Closing the polygon

When you have positioned the final marker you want to use, *double-click* it to indicate that it is the final marker in the polygon. A line is drawn from it to the first marker. No new marker appears after you double-click the final one.

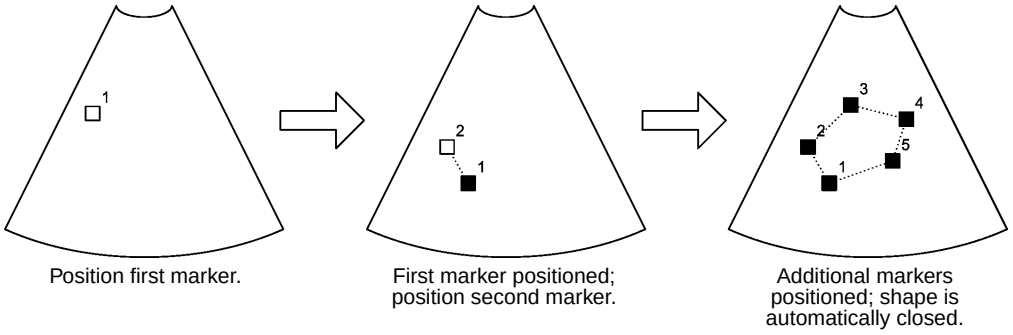

Position first marker.
First marker positioned; position second marker.
Additional markers positioned; shape is automatically closed.

Figure 5-9. Drawing a polygon.

After the markers have been positioned, you can move any of them by clicking and dragging to a new location. Click again.

Repositioning a polygon marker

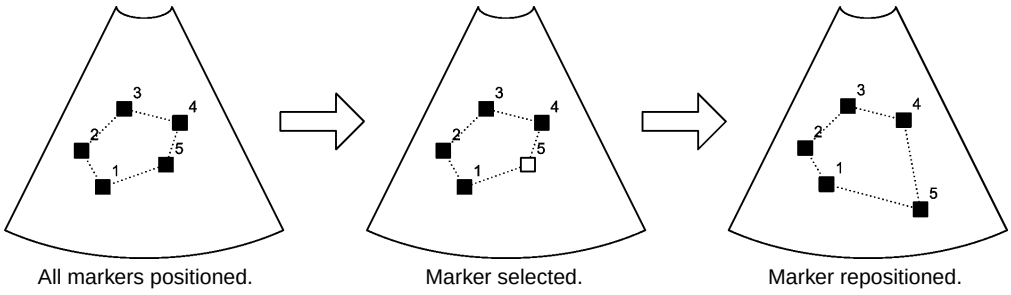


Figure 5-10. Repositioning one of the markers in a polygon.

To move the entire polygon without changing its size or orientation:

1. Click inside or on the polygon.
2. Drag it.
3. Click again.

You can move the shape to any location in the view.

Moving a polygon

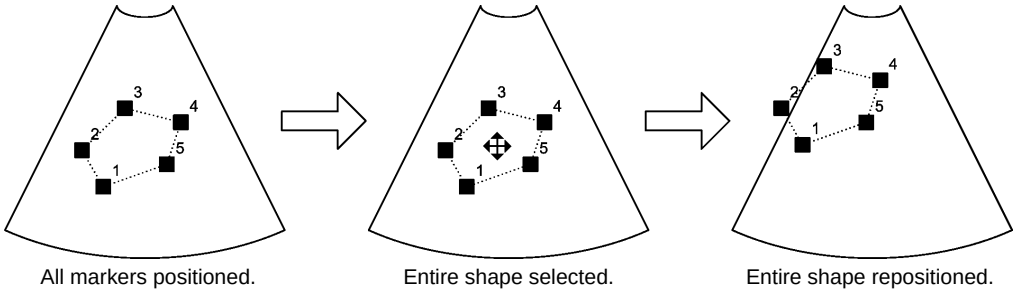


Figure 5-11. Moving a polygon you have drawn.

WARNING If the sides of the polygon intersect (as in forming a curve like a figure eight, for example), the area calculation is incorrect. In this case, the calculated area of the polygon is the area of the bigger loop minus the area of the smaller loop.

Freehand Drawing on a B-Mode or Color Mode Image

On a B-mode or Color mode image, you can draw a closed shape freehand.

To draw freehand:

1. Click the measuring tool on the screen:

   A drawing cursor appears.
2. Drag it to where you want to start drawing. Click.

   A second marker appears where you clicked.
3. Drag it to draw the shape you want.

Erasing what you have drawn

To delete backward from the cursor, press - on the [+/-] key. The cursor is automatically moved back. To undo the deletion, press +.

4 When you have finished drawing, click the drawing cursor.

The shape is automatically closed by a straight line from the drawing marker to the first marker (starting point).

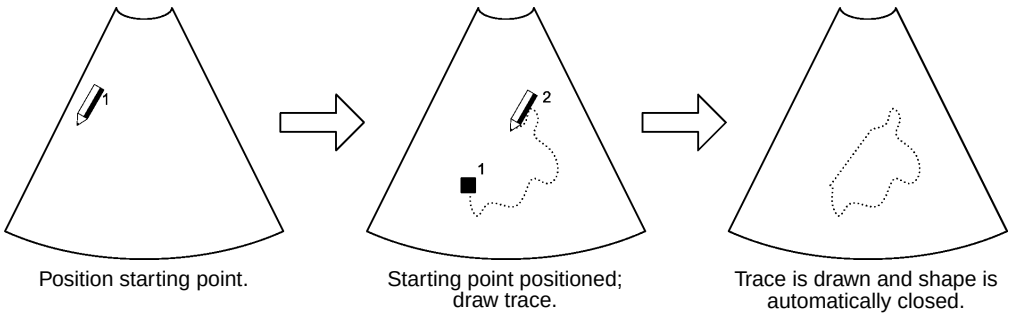


Figure 5-12. Drawing a freehand shape.

You can move the shape to any location in the view.

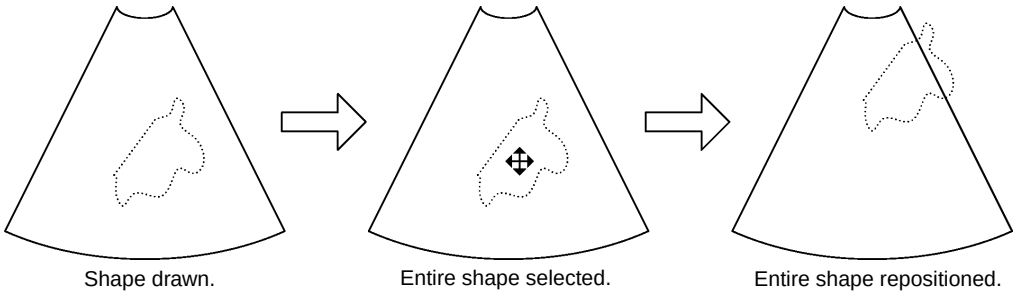


Figure 5-13. Moving a shape you have drawn freehand.

Doppler Mode Measuring Tools

Making measurements on a Doppler mode image is different (from measuring on a B-mode or Color mode image) because the Doppler mode image has time as a dimension. To avoid getting a negative result, successive markers must be positioned to the right, not the left, of any already-positioned markers.

Positioning 2 Point Markers on a Doppler Mode Image

While you are positioning a marker, 2 cursor lines are displayed. One is horizontal and one vertical, intersecting at the marker position.

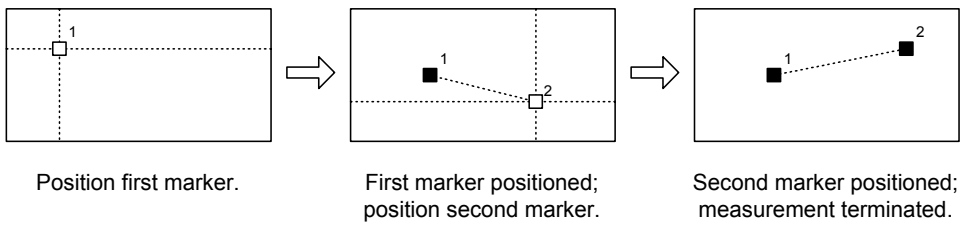


Figure 5-14. Positioning 2 point markers on a Doppler mode image.

After you position the markers, you can move one of them by clicking it and dragging it. Click again when you have positioned it where you want it.

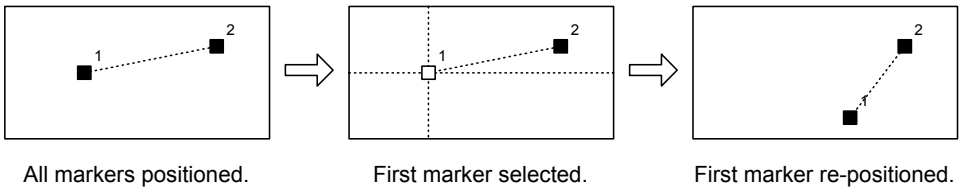


Figure 5-15. Moving a marker you have placed on a Doppler mode image.

You can position the markers anywhere in the Doppler mode image.

The appearance of the markers and whether they are connected by a dotted line depends on what you are measuring.

Positioning 1 Point Marker on a Doppler Mode Image

If you are measuring something that needs only one marker, position the marker in the same way as for 2 markers.

Positioning 2 Vertical Line Markers on a Doppler Mode Image

Two vertical line markers can be positioned on a Doppler mode image to measure intervals.

To position the vertical markers:

1. Click the measuring tool.

   A marker appears on the image.
2. Drag this to the position you want. Click.

   Another marker appears.
3. Drag it to the correct position. Click.

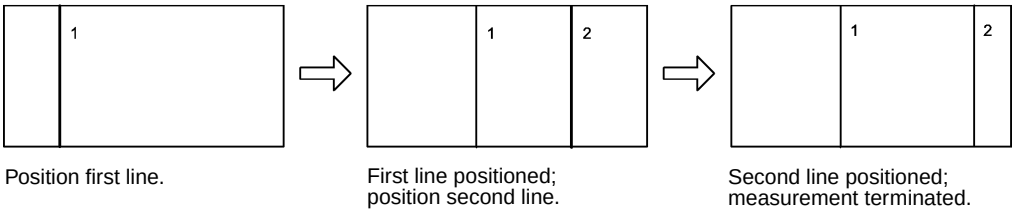
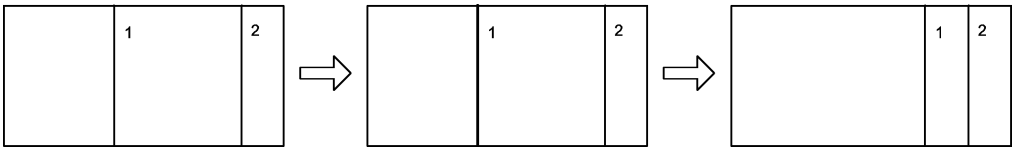


Figure 5-16. Positioning vertical markers on a Doppler mode image.

After you position the markers, you can move one of them by clicking it and dragging it. Click again when you have positioned it where you want it.



All lines positioned. First line selected. First line repositioned.

Figure 5-17. Moving a vertical line marker you have placed on a Doppler mode image.

Freehand Drawing on a Doppler Mode Image

On a Doppler mode image, you can draw an outline curve freehand.

To draw freehand:

1. Click the measuring tool on the screen:

   A drawing cursor appears.

2. Drag it to where you want to start drawing. Click.

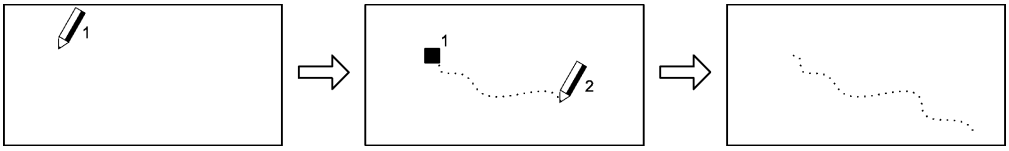
   A starting point marker appears where you clicked.

3. Drag the drawing cursor to draw the shape you want. (You can only drag to the right; you cannot drag to the left.)

   Erasing what you have drawn

   To delete backward from the cursor, press **-** on the [+/-] key. The cursor is automatically moved back. To undo the deletion, press **+**.

4. When you have finished drawing, click the drawing cursor.



Position starting point. Starting point positioned; draw trace. Trace is drawn.

Figure 5-18. Drawing a freehand curve on a Doppler image.

Chapter 6
Documentation

What are documents?

This chapter describes ways to manage documents. There are different types of documents:

- 2D scanned images
- 2D video clips of scans
- 3D data sets
- Pro Package reports

In this chapter, the term “document” refers to all of these types of documents unless a particular type is specified.

Patient Archiving

The patient archiving system contains information about patients and examinations, including comments about patients or documents. When you save a document during an examination, it is saved directly into the patient archiving system on the scanner. If the document browser is open, it is automatically updated to show the saved documents from the current examination.

NOTE: *The patient archiving system can be password-protected. See page 115.*

Hard Disk Quota

The scanner hard disk does not have unlimited storage capacity. Each document that you save to the patient archiving system takes up space on the hard disk. The scanner checks the space on the hard disk each time you enter a new patient ID. If the hard disk is getting full, you will be notified:

when there is no more than 1 GB available space on the hard disk.

when there is no more than 500 MB available on the hard disk.

when there is no more than 300 MB available on the hard disk. At this point, you will not be allowed to save any more information to the hard disk.

To clear space on the hard disk, you must delete some documents. You can archive them to a CD or PACS (if you have DICOM installed) before you delete them from the hard disk.

NOTE: *If you have archived the documents to a CD, wait to delete them from the hard disk until you have successfully burned the archive CD. See “Using CDs” on page 109. If you have archived them to a PACS, make sure that they have been transferred successfully into the system before you delete them from the scanner hard disk.*

The Document Browser

You use the document browser at the bottom of the screen to review and manage documents stored in the patient archiving system. You can also use it to review documents stored or archived on external media. You cannot review documents stored on a PACS.

The document browser contains an image bar with a toolbar underneath it.

To open or close the document browser:

- Click **View Exam.** or **View Archive** in the toolbar at the bottom of the screen.

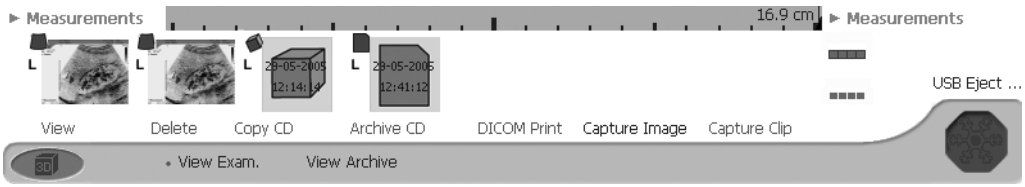


Figure 6-1. The document browser window.

The Image Bar

The image bar contains thumbnails of the available documents.

A small icon in the upper left corner of each thumbnail identifies the document type and whether it is archived internally or externally.

Icon	Document Type
	2D image
	3D data set
	Video clip
	Report
L	Document is stored locally
A	Document is archived
	Note: If document is archived and stored locally, both L and A appear.

Table 6-1. Documentation type icons.

If the browser contains so many images that the thumbnails cannot fit on the screen, you can use arrows ◀ ▶ at the left and right end of the image bar to scroll through the thumbnails.

The Document Browser Toolbar

The toolbar below the image bar contains the tools you can use in the document browser.

Tool	Function
View	Displays the currently selected document (2D scanned image, 2D video clip of scans, 3D data set, Pro Package report).
Delete	Deletes the currently selected document (See page 106).
Copy CD/ Copy Flash	Copies the selected documents to an external storage device. Note: *All copy (save) keys on the control panel and any on-screen copy controls are disabled when the document browser is open (See page 108).*
Archive CD Archive DICOM	Places information to be archived in the staging area (Archive CD) or sends it to a PACS (Archive DICOM) (See page 109)
DICOM Print	Sends selected documents to a queue to be sent to a DICOM printer (See page 111).
Capture Image	Saves the current scanned image (frozen or not) to the patient archiving system.
Capture Clip	Saves the clip (image sequence) from now and backward in time to the patient archiving system. You can capture a clip when the image is frozen or not frozen.
	Click top icon to select all thumbnails in the document browser. Click bottom icon to deselect all thumbnails in the document browser.

Table 6-2. Document browser tools.

Saving Documents

2D Images and Video Clips

To save a 2D image or video clip to the patient archiving system, Click **Capture Image** or **Capture Clip** in the Document Browser toolbar.

You can also set up user-defined keys to capture images and clips, or you can set up a key so that it captures images if the image is frozen and captures clips if the image is not frozen. See “User-Defined Keys” on page 169.

Image format

Images are saved in .bmp format. Video clips are saved in .avi format.

Clip storage

You can customize the way video clips are captured and stored. For example, you can set their length and frame rate. See “Clip Storage and Cine Setup” on page 173.

3D Data Sets

3D data sets are automatically saved to the patient archiving system.

Reports

To save a report to the patient archiving system, click **Save** in the report.

Viewing Documents

To view thumbnails of documents in the document browser:

- To see documents associated with the current examination, click **View Exam.** in the toolbar at the bottom of the screen.

  Small pictures (thumbnails) of 2D images, video clips, 3D data sets or reports from the current examination are displayed in the document browser.

  NOTE: *Clip Storage may have been disabled. See “Clip Storage and Cine Setup” on page 173.*

- To see other documents in the patient archiving system, click **View History**. The **Archive** window opens. See“The Archive Window” on page 103.

To select or unselect a document:

- Click the document.

  A colored frame surrounds the documents that are selected.

To view a document:

- Double-click the document in the browser.

  The document is displayed in the scan area, and any other documents you have selected are deselected.

or

- Select a document and click **View**. (You cannot do this if more than one thumbnail is selected.)

  NOTE: *If a report has been saved, you can view it, but you cannot edit it.*

Viewing a Video Clip

When you view a video clip or cine image, there are special controls you can use to play, pause or go forward or back.

Video Clip Control	Function
	Play
	Pause
	Works when clip is paused. Point at this and press **+** to go one frame forward or press **-** to go one frame back. If you click this, a slider appears. Use the slider to move back and forth through the images. (Only available for video clips.)
Close Review	Closes the review in the scan area.

Table 6-3. Viewing controls for cine images and video clips.

The Archive Window

You use the **Archive** window together with the document browser to manage all the documents in the patient archiving system. You can view documents, delete documents, copy documents, archive documents and send them to a PACS or DICOM printer.

To open the Archive window:

1. Click **View History** in the toolbar at the bottom of the screen. (If the patient archiving system is password-protected and you are not logged on, this option is not visible.)
2. Click the **Archive** tab.

   The **Archive** window opens.

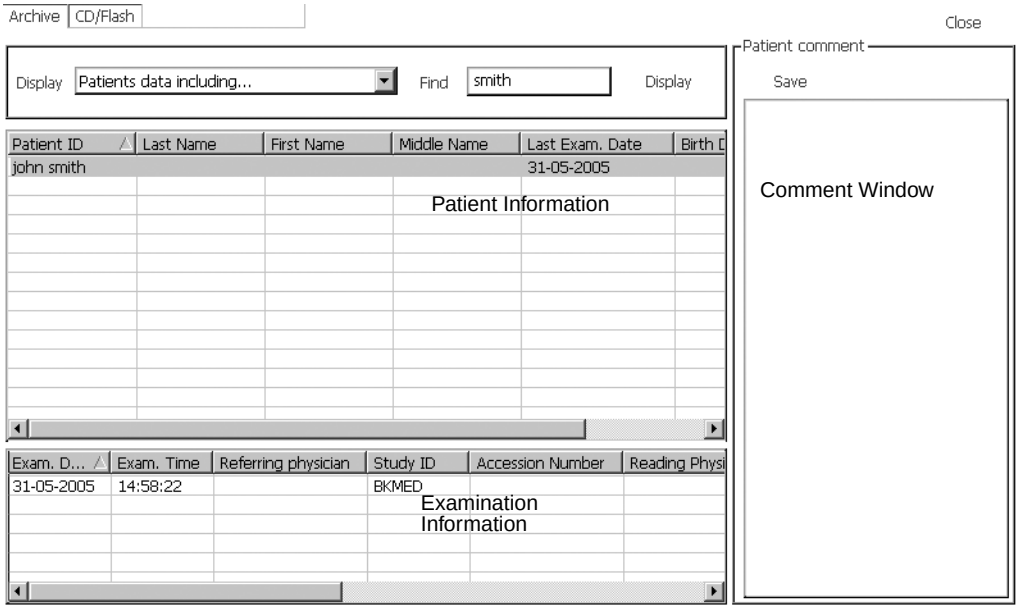


Figure 6-2. The Archive window.

The **Archive** window has 3 parts:

- a lists of patients
- a list of examinations of the selected patients
- a comment window

Patient Information

The Patient Information area contains patient IDs, names, and other information about patients in the patient archive. It also contains the date of the last examination for each patient. You can filter the information so that only certain patients are displayed. Table 6-4 explains the various ways you can filter the patient list.

Select this in the Display field	Type this in the Find field	Patients Displayed
Current patient's exams	*Not applicable*	The current patient (the one whose ID is displayed at the top of the screen).
Patients with exams before...	A date. (See "Entering Dates" on page 39.)	All patients who have any examination before the date you enter.
Patients with exams after...	A date. (See "Entering Dates" on page 39.)	All patients who have any examination after the date you enter.
Patients data including...	Smith	Patients named Smith, Smiths, Smithson, Whitesmith and those with other names containing "Smith"
	1975	All patients born in 1975
Patient with patient ID	the exact patient ID	The patient with a specific patient ID.
Patients comment including...	"severe" (for example)	All patients with a patient comment that contains "severe".
Patients document comment including...	"tumor" (for example)	All patients with a document comment that contains "tumor".
All patients	*Not applicable*	All patients
Not archived	*Not applicable*	All patients that have no archived examinations
All archived	*Not applicable*	All patients with at least one archived examination
Patients examined today	*Not applicable*	All patients that have been examined today

Table 6-4. Ways to select the patients displayed in the Archive window.

Sorting columns

You can sort the listed patients according to the information in one of the columns by clicking the column heading. For example, if you click the **Last Name** column, the listed patients will be sorted alphabetically by last name.

Rearranging columns

You can move the columns to rearrange them. Click a column you want to move and drag it to a new position.

Examination Information

To see the records (examinations) for particular patients, click the patient information row containing the patient. (To select more than one row, press [Ctrl] while you click.) The list in the examination information area is updated to display examinations from the selected patient(s).

To see documents from a particular examination, click the row containing the examination. (You can select more than one.) The document browser is updated with the thumbnails of documents of the selected examination(s).

Patient and Document Comments

The comment window to the right of the **Archive** window is a **Patient Comment** window if a patient or examination is selected. If a document in the document browser (see next section) is selected, the window is an **Document Comment** window.

Existing comments are displayed in date order with the newest comments at the top.

To enter a comment:

1. Click in the comment window.

   The current date and time are displayed at the top of the window.
2. Type the comment under the date and time.
3. Click **Save** above the comment window.

   NOTE: *You can edit previously saved comments.*

Deleting Patients or Documents

You can delete documents from the scanner if they have not been archived, but you can never delete an archived document.

You can delete a patient record if the patient has no archived documents.

To delete a patient with no archived documents:

1. Click to select the row containing the patient. To select more than one row, press [Ctrl] while you click.
2. Click **Delete** in the toolbar below the document browser.

   You will be asked to confirm that you want to delete the patient.
3. Click **Yes**.

   All local documents for the patient are deleted. The patient is deleted in the patient archive if documents for the patient have been archived (that is, if they only appear locally in the patient archiving system).

To delete all documents associated with an examination:

1. Click to select the examination. To select more than one row, press [Ctrl] while you click.
2. Click **Delete** in the toolbar below the document browser.
3. You are asked to confirm that you want to delete the documents.
4. Click **Yes**.

   The documents associated with the selected examination(s) are deleted.

   NOTE: *The examination record itself is never deleted (unless you delete the patient).*

To delete one or more non-archived documents:

1. Click the images in the document browser to select them.
2. Click **Delete** in the toolbar below the document browser.
3. You are asked to confirm that you want to delete the documents.
4. Click **Yes**.

   The selected documents are deleted.

Externally Stored Documents

You can also use the document browser to look through documents that you have copied or archived to a CD or flash memory device.

To view externally stored documents:

1. Insert a CD into the CD drive or insert a flash memory device into the USB connector.
2. Click **View History** in the toolbar at the bottom of the screen. (If the patient archiving system is password-protected and you are not logged on, this option is not visible.)
3. In the window that appears, click the **CD/Flash** tab.

   The **External Documents** window appears, containing a list of the folders on the external storage device(s).

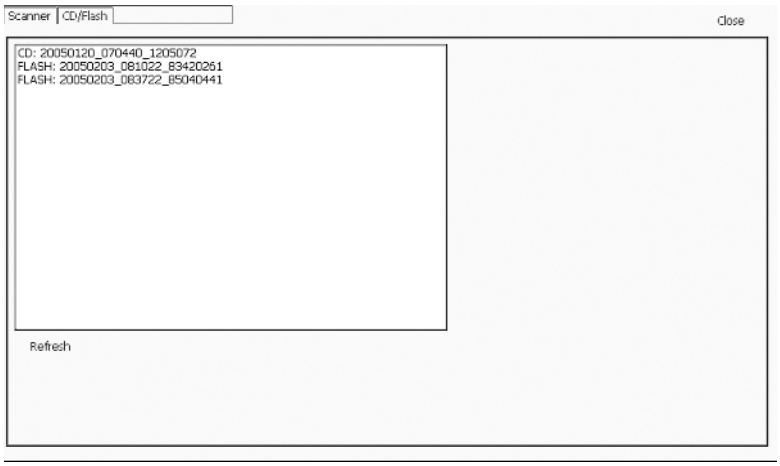


Figure 6-3. The External Documents window.

4 Click to select a folder.

The document browser is updated with the documents in the selected folder.

Copying and Archiving Documents

Copying and Archiving

Copy You can copy documents associated with a patient to a CD or flash memory device.

Archive You can archive documents to a PACS or to a CD.

The difference between archiving and copying a document is that when you archive, the patient archiving database is copied to the storage medium.

Copying Documents

You can copy documents to a CD or a flash memory device. See “Using CDs” on page 109 and “Using Flash Memory” on page 111.

To copy individual documents or all the documents associated with a specific examination or patient to a CD or flash memory device:

1 Click to select the patient, the examination, or the individual documents you want to copy.

2 Click **Copy CD** or **Copy Flash**. (The one you last used is displayed. When you point at it, a triangle appears to the right.)

3 Click the triangle and then click to select the other medium.

The documents are copied to the CD staging area or to the flash memory device.

Archiving Documents

You can archive documents to a CD or a PACS (if you have DICOM installed on your scanner). See “Using CDs” on page 109 and “Using the DICOM System” on page 111.

To archive all documents for a patient or examination or individual documents:

1. Click to select the patient, the examination, or the individual documents you want to archive.
2. Click **Archive CD** or **Archive PACS**. (The one you last used is displayed. When you point at it, a triangle appears to the right. Click to select the other archiving destination.)

   If you archive to a CD, you are asked for a volume name.

Format of Saved Documents

Image format and labels

Images are stored in .bmp format and labelled with a code that specifies the date and time the image was captured. For example, 2D_20041022_135426_FV12345.bmp would be the label on an 2D image of patient FV12345 that was captured on October 22, 2004 at 1:54:26 P.M. (13:54:26).

Supported CD types

The following media are supported:

- CD-R (recommended for most purposes)
- CD-RW

Caution: Be careful when you use the CD drive. Insert discs carefully. Do not use force. Do not push the drive to close it – use the button on the drive when you insert or eject a disc.

Using CDs

There are certain restrictions about copying and archiving to a CD:

- You cannot burn both archived and non-archived documents to the same CD.
- You cannot archive to a CD that is not blank.
- You can copy to a non-blank CD.

  NOTE: *CDs are vulnerable, and data may be corrupted when they are saved to a CD. After you save, check the CD to make sure that your data are saved properly. Remove the CD from the scanner before you turn it off because data can also be corrupted when the scanner shuts down.*

Staging Area

When you click **Copy CD** or **Archive CD**, the selected documents are not copied immediately to a CD. They are moved to a staging area. You can add more files to the staging area before you burn them to a CD.

Files in the staging area do not disappear when you turn off the scanner. When you turn on the scanner, if there are files waiting to be burned to a CD, the following window appears:

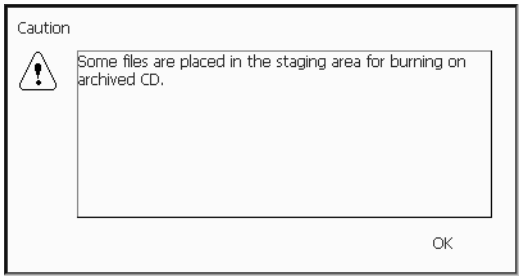


Figure 6-4. Reminder that some files are in the staging area, waiting to be burned to a CD.

If you try to copy or archive documents and the total, including what is already in the staging area, is too big to fit on a CD, you are informed that you cannot copy the documents to the staging area.

Burning a CD

To burn archives or copies to a CD:

1. Insert a CD into the CD drive.
2. Click **Burn CD..** under **Image** on the right side of the screen.

   The following window appears:

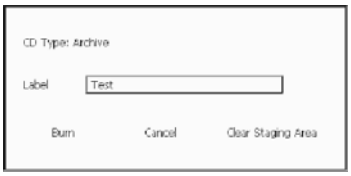


Figure 6-5. The Burn CD window.

3. If you are burning a copy, you must type a label name.
   If you are burning an archive CD, you cannot specify the label name.
4. Click **Burn**.

   The progress bar tells you when the burning is finished. The keyboard panel and on-screen controls are disabled while the CD is being burned.

   You can also use this window to clear all documents from the staging area.

Clearing the staging area

Caution: You cannot see what documents are in the staging area. There is a risk of losing data if you have put something there (for example by clicking **Copy CD**) and then deleted it from the patient archiving system on the scanner. To remind you about this, the following window appears when you click **Clear Staging Area**.

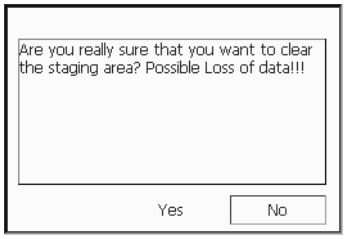


Figure 6-6. Caution about clearing the staging area.

Using Flash Memory

When you copy documents to a flash memory device, make sure that you have inserted the device into the USB connector.

When you click **Copy Flash,** the copying starts immediately. (Unlike for CDs, there is no staging area.)

The keyboard panel and on-screen controls are disabled while documents are being copied.

Caution: Before you remove the memory device, click **Eject USB** at the right side of the document browser. See Fig 6-1. You will be notified when it is safe to remove the memory device (no risk of losing data).

Using the DICOM System

The information in this section only applies if DICOM is installed on your scanner.

Can't measure on a DICOM image

NOTE: *You cannot make measurements on a DICOM image because the picture geometry information that would be required is not stored with the image.*

Saving or Printing to a DICOM Network

When you archive or save to a Picture Archiving and Communications System (PACS), the information is temporarily saved on the scanner's internal hard disk. When the PACS is available, the information is transmitted. Information is deleted from the internal hard disk after it is successfully transferred to the PACS.

The DICOM setup on the scanner specifies the amount of time images are stored on the scanner's internal hard disk before being discarded. The default time period is 2 days. If stored images are not transferred to the PACS before the specified time period, a message appears the next time you try to save an image.

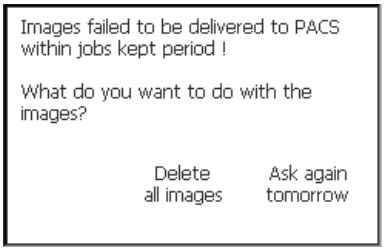

Images failed to be delivered to PACS within jobs kept period !
What do you want to do with the images?
Delete all images
Ask again tomorrow

Figure 6-7. Message when stored images are not sent to the PACS.

Make sure that stored data are transferred to the network

Caution: When you use the DICOM functions, you must connect the scanner to a functioning network with access to the requested services (print or storage) at least once every 5 work days. Otherwise the internal hard disk may overflow. When the disk is full, the following message appears.

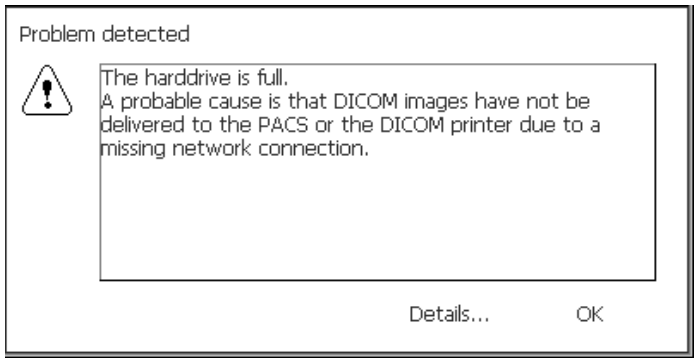

Problem detected
The harddrive is full.
A probable cause is that DICOM images have not be delivered to the PACS or the DICOM printer due to a missing network connection.
Details...
OK

Figure 6-8. DICOM message when hard disk is full.

DICOM Status

A DICOM status indicator appears at the bottom right of the screen. It has a little light next to it.

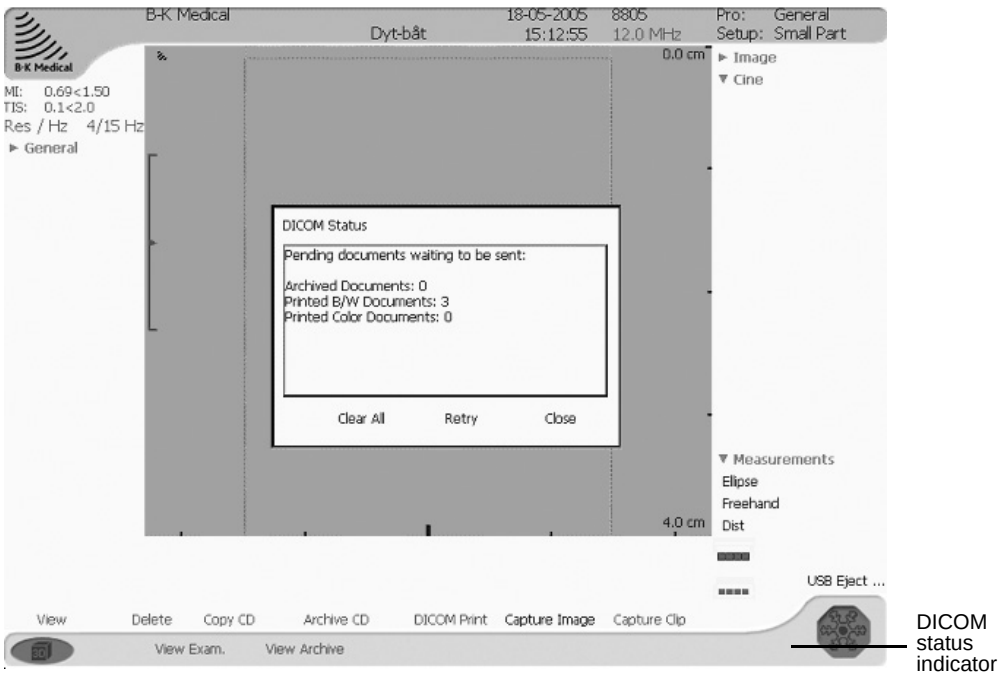


Figure 6-9. DICOM status indicator and status window.

- Green indicates no unsent images. This times out after 5 seconds.
- Yellow indicates that a DICOM session is in progress (data are being transferred to a DICOM system).
- Red indicates that some unsent images remain after a DICOM session.

If you click the indicator, the status window appears. You have the following options:

- **Clear All** – clear all pending documents
- **Retry** – try to send again
- **Close** – do nothing

Printing Documents

You can print documents on a local printer or, if DICOM is installed on your scanner, send them to be printed on a DICOM printer.

Printing on a DICOM Printer

To print on a DICOM printer:

1. In the document browser, click to select the documents you want to print:
2. Click **DICOM Prin**t.
3. The documents are sent to a DICOM printer.

Printing on a Local Printer

To print the screen using a local printer:

- Press [ ] or the user-defined key assigned to printing.

Reports

Reports are defined for each Pro Package. A report contains information about the patient and the measurements you have made.You can add remarks to a report. You can save a report to the patient archiving system and view or save it in the same way as you view or save other documents. See page 101.

Displaying a Report

To create a report:

- Press [**F8**] (**Report)** or a user-defined key.

  The report appears on the screen.

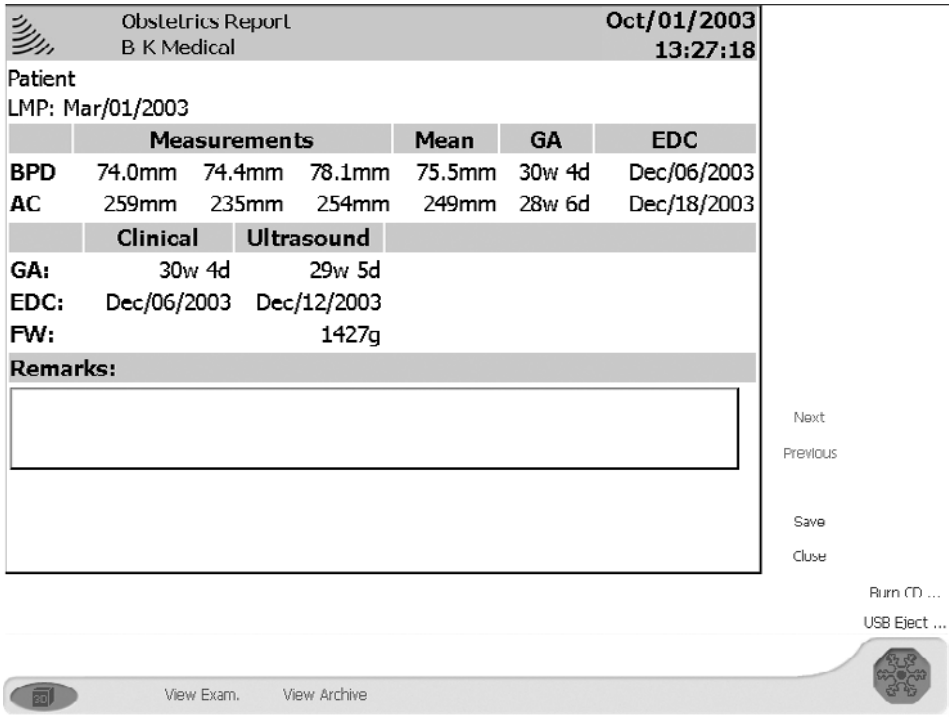


Figure 6-10. An OB report.

The contents of the report will vary, depending on the Pro Package and the measurements you have made.

If the report has more than one page, click **Previous** and **Next** to navigate through the pages.

To add a remark to a report:

- Type in the remark area.

Printing a Report

To print a report:

- Press the key that is assigned to printing.
  The current page of the report is printed. If the report has more than one page, click **Next** or **Previous** to view other pages of the report and print them.

Saving a Report to the Patient Archiving System

To save the report to the patient archiving system:

- Click **Save** on the report.

  NOTE: *You cannot edit a saved report.*

Password Protection of the Database

The HIPAA (the American Health Insurance Portability and Accountability Act of 1996) sets standards for handling patient data and medical records. To comply with these standards, the patient archive database on the scanner can be password-protected with a user-specific ID (username) and password.

If you copy the database to a CD and try to open it with Microsoft Access™, you will be prompted for a (different) password if the database is password-protected. This password for exported databases cannot be changed.

If the database is password-protected, when you turn on the scanner, a login window appears:

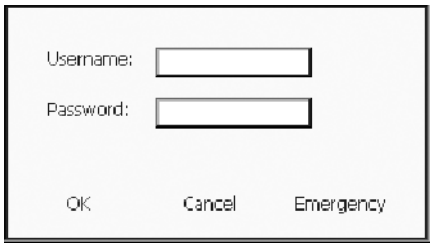


Figure 6-11. The login window.

Enter your username and password and click **OK**. To change your password, see “Password Setup” on page 176

Not Logged In

If you click **Cancel** in the window, you can use the scanner but you cannot use the patient archiving system or the 3D system. This means you cannot capture images or clips or 3D data sets. You also cannot see patient information or documents in the patient archiving system.

If you press [ ] to start the 3D system, the login window appears. If you log in, you are allowed to use the 3D system (if you have a license for it).

The login window also appears if you try to enter a patient ID when you are not logged in.

Emergency State

In an emergency, someone without a password may need to use the scanner and there may not be time to type in a name and patient ID. In this case, when the login window appears, click **Emergency**. This puts the scanner in the emergency state.

In the emergency state, a default patient ID ("EmergencyID") is used. You can capture images and clips, but they will all have "EmergencyID" as the patient ID.

> **NOTE:** *If you have clicked Emergency in the login window, do not send pictures to a PACS because they will be identified as EmergencyID and you will not be able to identify pictures from different patients.*

You can log in with your password at any time. When you do that, the emergency ID disappears and you must enter a patient ID.

Part 3: Imaging Modes

Chapter 7
B-Mode – 2D Imaging

Overview

B-mode ultrasound gives real-time 2D information about the anatomical structure of soft tissues.

Combination modes

B-mode can be used in combination with other scanning modes. See “Combination Modes” on page 128.

To return to scanning with B-mode alone after you have been using it in combination with other modes, press [B].

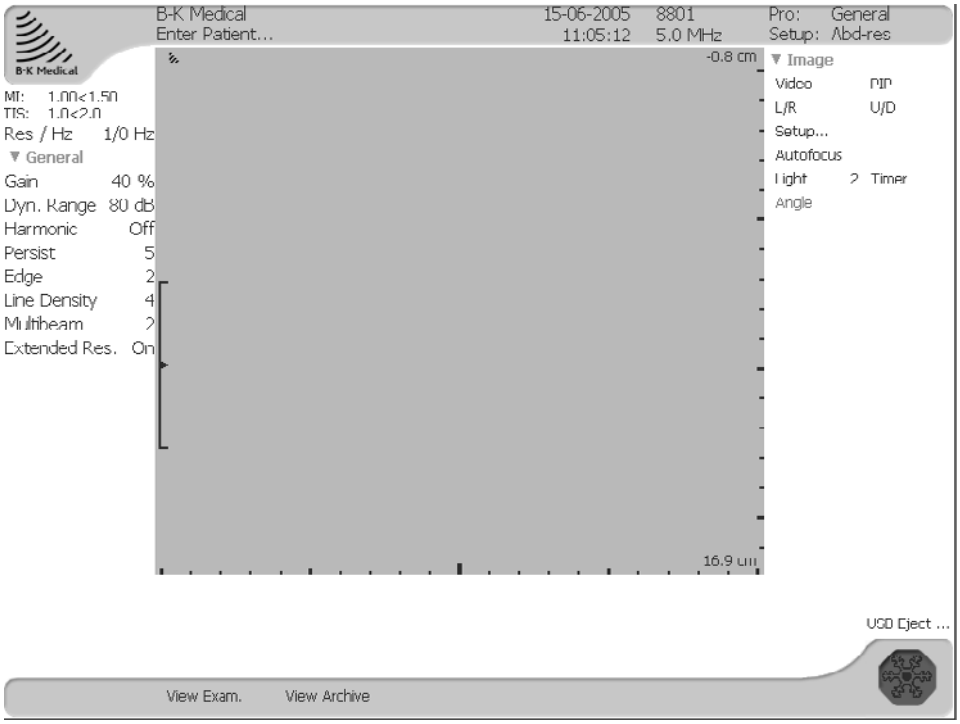


Figure 7-1. B-mode image.

Adjusting MI

You can adjust the maximum allowed MI (mechanical index).

To adjust the MI limit:

- Click **MI** above **Gain** on the left side of the screen and drag the slider.

Adjusting the Scan Area

Depth

Full B-mode image

With a full B-mode image, you adjust the depth to cut out parts below the part you are interested in. The scanned image always includes the transducer surface, so this key changes the magnification of the image, stretching or compressing it.

> **NOTE***: To adjust the depth of the image without changing the magnification, see "Panning" on page 124. When the image is panned, the top of the image does not necessarily still correspond to the transducer surface.*

Zoomed image

Adjusting the depth of a zoomed image (see "Zoom" on page 123), changes the magnification even though the transducer surface is not necessarily visible at the top of the image.

There are two ways to adjust image depth.

To adjust image depth:

- Make sure the cursor is located within the image and press [**+/-**].

or

- Press the [**Depth**] key to increase or decrease depth.

  NOTE*: Pressing the* **+** *end of the key up decreases the depth – increases the magnification.*

When the depth has been adjusted, **Zoom/Pan** is visible under **Image** on the right side of the screen, together with a small indicator light.

To return to original depth:

- Click **Zoom/Pan.**

Width

You can adjust the width of the scan area in a B-mode image. A narrow width allows for greater frame rate without a loss of image resolution.

To adjust the width of the scan area:

- Press the [**Width**] key to increase or decrease width.

Gain

To adjust the gain (brightness) of the scanned image, use a combination of the [**B Gain/Cine**] dial and the [**TGC**] (Time Gain Compensation) sliders on the control panel.

B-Mode Gain

The [**B Gain/Cine**] dial determines the overall amplification that is applied to ultrasound echoes from all depths.

To adjust the overall gain:

- Turn the [**B Gain/Cine**] dial.

or

- Click **Gain** under **General** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

The current overall gain setting (a percentage) is displayed on the screen next to **Gain**.

TGC

The TGC curve determines variable amplification applied to echoes from different depths in the tissue. The TGC function compensates for attenuation and scattering of the ultrasound beam in the tissue.

When you select a transducer, if all TGC sliders are in the center position, scanning starts using a default TGC curve optimized for the transducer. (The default is either the one set at the factory or one you have set up yourself. See Chapter 13, “Setting Up and Customizing Your System”.)

The [**TGC**] sliders adjust the relative gain of the image at different tissue depths. Each slider adjusts a specific part (1/8th) of the TGC curve; the topmost control adjusts the top 1/8th of the image.

> **NOTE:** *The sliders operate relative to their center position; when they are all centered, the default TGC is used.*

To adjust the TGC curve:

- Move the [**TGC**] sliders to the right or left to adjust the TGC curve.

  The shape of the TGC curve is temporarily displayed to the right of the image as a curved vertical line. This indicates the modification that is applied to the default TGC curve.

  NOTE*: The TGC curve operates on the screen image, not on the ultrasound echo. Thus if you move or resize the image, you may have to readjust the TGC curve.*

360° transducers

  NOTE: *With 360° transducers, the top slider adjusts the part of the image that is most central – that is, closest to the transducer.*

Focus

The ultrasound image is focused very sharply within a selected zone, while the rest of the image is not as well focused. The Pro Focus can use either a single focal zone or multiple (up to 8) focal zones (multiple focusing).

Multiple focus and resolution

When more than one focal zone is active, ultrasound beams are focused at different depths in the tissue. This improves the focus in several zones. However, using more focal zones gives a lower frame rate. Thus using multiple focal zones when there is much tissue movement causes the image to be blurred.

The **Focus** indicator to the left of the image shows the extent (range) of the focal region as well as the points of best focus.

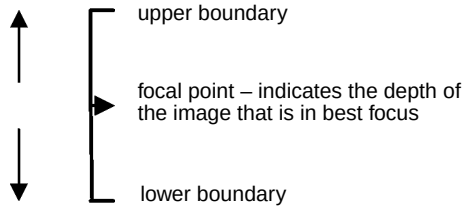


Figure 7-2. The Focus indicator.

The focal point triangle indicates the depth of the image that is in best focus – the focal point. If there is more than one focal point (composite focus), the number of triangles indicates the number of focal points (but not necessarily their position, because this is automatically optimized).

You can adjust both the position and range of the area in best focus. You can also select the number of focus zones.

To adjust focus position:

To move the focus up or down on the image, select the focus indicator and drag it vertically to the desired position on the image.

1. Select the **Focus** indicator by clicking on it or pressing [ ].
2. Drag the **Focus** indicator to the desired position.
3. Click.

To adjust focal range:

- Point at the **Focus** indicator and press [**+/-**].

or

- Click one of the focus boundary indicators. Drag it and click, or press [**+/-**].

Any changes you make to focus settings can be saved in a Diagnostic Setup.

Number of Focal Zones

When you choose to have more than one focal zone, the zones are automatically positioned within the focal range to give a uniform resolution throughout the range.

To select the number of focal zones:

- Press [**Resolution**] to increase or decrease the number of focal zones.

or

- Click **Res/Hz** on the left side of the screen and select the value you want (or point at **Res/Hz** and press [**+/-**]).

The current number of focal zones and frame rate are displayed on the screen next to **Res/Hz** (as **x/y Hz**, where x is the number of focal zones and y is the frame rate).

Autofocus

Autofocus ensures that the center of the focal range is always centered in the displayed image.

To turn autofocus on or off:

- Click **Autofocus** on the right side of the screen.

Dynamic Range (Contrast)

You can adjust the dynamic range (contrast) of the ultrasound image from 50 to 90 dB.

To adjust dynamic range:

- Press [**Dyn Range**] to increase or decrease the level

or

- Click **Dyn. Range** under **General** on the left side of the screen and drag the slider (or point at **Dyn. Range** and press [**+/-**]).

The current dynamic range setting is displayed on the screen next to **Dyn. Range**.

Zoom

Zoom

To zoom in or out on the area you are interested in, adjust the Zoom box and then make the part of the image that is inside the box fill the screen.

- To zoom in on a small part of the scanned area, make the box smaller.

When you press [ ], the result depends on how many times you have already pressed it. A long press on [ ] turns off the Zoom box.

Pressing the [🔍] key	Does this	You can
First press	Turns on the Zoom box and selects it. You can move (drag) it or resize it.	Move it (drag) or resize it ([+/-] key).
Second press	Makes the contents of the (selected) Zoom box fill the entire screen.	Press [🔍] to return to the previous image.
Third press	Returns image to the state it was in before the first press.	

To use the Zoom box (zoom on different parts of the image)

- Press [🔍].
  A Zoom box appears superimposed on the scanned image. It is selected (can be dragged) when it appears. If the box is present but not selected, click inside the box to select it.

Moving the Zoom box

- To move the Zoom box to a different part of the image, drag the box with the trackball. Click to release the cursor when the box is where you want it.
- If the Zoom box is visible but not selected (you cannot drag it to move it), click inside the box to select it, then drag it.

Zooming in and out

- To resize the box (zoom in or out), press [+/-] when the box is selected.

  You can also resize the box by clicking one of the corners (selecting it) and then dragging the corner or using the [+/-] key.

When the image has been zoomed, **Zoom/Pan** is visible under **Image** on the right side of the screen, together with a small indicator light.

To return to the original image:

- Press [🔍].

Panning

Panning is moving the image so that different parts of the total scan are displayed on the screen.

You can pan in any direction, though only as far as the scan area of the individual transducer permits.

To pan the image:

- Double-click on the image and drag it.

When the image has been panned, **Zoom/Pan** is visible under **Image** on the right side of the screen, together with a small indicator light.

To return to the original image:

- Click **Zoom/Pan** under **Image** on the right side of the screen.

Persistence

Persistence is the amount of time over which B-mode image frames are averaged on the screen. High persistence increases the contrast in the image, but tissue movement will blur a high-persistence image.

You can select the persistence level of the ultrasound image.

To adjust B-mode persistence:

- Click **Persist** under **General** on the left side of the screen and select the value you want (or point at **Persist** and press [**+/-**]).

  The available values range from 1 (no averaging) to 8 (maximum averaging).

  The current setting is displayed on the screen next to **Persist**.

Edge Enhancement

Edge enhancement is a way of emphasizing contours so that edges stand out more clearly.

You can select the degree of edge enhancement of the ultrasound image.

To adjust edge enhancement:

- Click **Edge** under **General** on the left side of the screen and select the value you want (or point at **Edge** and press [**+/-**]).

  The available values range from 0 (no enhancement) to 7 (maximum enhancement).

  The current setting is displayed on the screen next to **Edge**.

Auto

Increasing the resolution of an ultrasound image results in a reduction in frame rate. The system can automatically adjust several parameters to give the best combination of resolution and frame rate.

In Auto, you can choose the priority given to resolution over frame rate (**Res**/**Hz**) from one of four options.

To turn Auto on and off:

- Press [**Auto**]

  NOTE: *When Auto is turned on,* **Multibeam**, **Line Density** *and* **Extended Res** *will be automatically set and will not be displayed on screen.*

To adjust the resolution:

- Click **Res/Hz** under **General** and select the resolution you want.

  The current setting is displayed on the screen next to **Res/Hz**.

Line Density

Line density is a measure of how closely spaced the scan lines are in the ultrasound image. Increasing the line density decreases the frame rate so that you get finer resolution but a slower refresh rate.

You can select the line density of the ultrasound image.

Line density is not available when Auto is turned on.

To adjust line density:

- Click **Line Density** under **General** on the left side of the screen and select the value you want (or point at **Line Density** and press [**+/-**]).

  The available values range from 1 to 5.

  The current setting is displayed on the screen next to **Line Density.**

Multibeam

Multibeam is a method for increasing the frame rate by receiving signals from several directions (at the expense of resolution).

Multibeam is not available when Auto is turned on.

To select the multibeam level:

- Click **Multibeam** under **General** on the left side of the screen and select the value you want (or point at **Multibeam** and press [**+/-**]).

  The available values are 1 and 2.

  The current setting is displayed on the screen next to **Multibeam**.

Resolution

You adjust resolution in the Pro Focus by adjusting the number of focal zones (see page 123) or line density (see page 126).

Extended Resolution

When B-mode only is scanning, you can use Extended Resolution to obtain better spatial resolution of the image at the cost of a lower frame rate.

Extended Res. is not available when Auto is turned on.

To turn Extended Resolution on or off:

- Click **Extended Res.** under **General** on the left side of the screen and select **On** or **Off**.

B-Mode Frequency – MFI

If an MFI (Multi-Frequency Imaging) transducer is selected, you can select the scanning (transmitted) frequency. The current scanning frequency is displayed at the top of the screen. (If harmonic imaging is turned on, the displayed frequency is the receiving frequency. See page 129.)

Harmonic imaging

To select the scanning frequency:

- Press [**Frequency** ↘] to step through the frequency options. (If you are using B-mode combined with other modes, the key works on Color, Power or Doppler frequencies instead of the B-mode frequency.)

or

- Click the current scanning frequency (for example, **5.0 MHz**) in the Identification area of the screen and select the value you want (or point at the frequency and press [**+/-**]).

The view must be scanning when you do this.

B-Mode Gray Scale

Several gray scales can be used to display a B-mode image. Different gray scales may make various aspects of the image clearer.

To select the gray scale in B-mode:

1. Point at the upper right of the image area.

   A gray scale bar appears.
2. Click the gray scale bar and select the gray scale you want.

   The gray scale bar is replaced by the one you select.

B Color

Instead of a gray scale, you can choose to have the B-mode image tinted with a color that you select.

To select a color for B color:

1. Click **B Color** under **Image** on the right side of the screen.
2. Click **B Color Setup...** under **B Color**.
3. In the window that appears, select the color you want.
4. Click **OK**.

The color bar that appears when you point at the upper right of the image area is replaced by one that uses the color you selected.

To turn B Color on or off:

Click **B Color** under **Image** on the right side of the screen.

Combination Modes

Duplex and triplex

B-mode can be used in combination with other modes. (The terms *duplex* and *triplex* scanning refer to combinations of 2 or 3 modes.)

The available combinations are:

- B+Color
- B + M
- B+Power
- B+Doppler
- B+Color+Doppler
- B+Power+Doppler

For details about the other modes, see the chapter for each mode.

To add another scanning mode:

- Press [**Color**], [**Power**] or [M] [⩚] to add Color, Power, Motion or Doppler mode.

To remove a scanning mode from the combination:

- Press the key for the mode you want to remove.

To return from a combined mode to B-mode only:

- Press [B].

  NOTE: *Pressing* [B] *several times lets you toggle back and forth between B-mode and any combined mode.*

Harmonic Imaging

Tissue Harmonic Imaging (True Echo Harmonics – TEH)

True Echo Harmonics (TEH) is B-K Medical's trademarked name for tissue harmonic imaging. Using it can reduce noise and improve the clarity of the ultrasound image.

In normal B-mode imaging, the transducer uses essentially the same frequency range for both transmitting and receiving. In harmonic imaging, the image is created by receiving higher frequencies (harmonics) that are multiples of the transmitted frequency (f). Tissue harmonic imaging in the Pro Focus is based on the 2nd harmonic (2f) spectrum.

Using TEH

TEH can be used only with transducers that support harmonic imaging.

Each Diagnostic Setup that permits TEH has default settings for overall gain, TGC gain, contour level, and contrast level for tissue harmonic imaging.

Restrictions

- TEH is available for B-mode imaging only. If more than one scanning mode is active, TEH will be disabled.
- TEH is available only for certain transducers.

  NOTE: *When TEH is turned on, the displayed frequency at the top of the screen is the receiving frequency. This is double the transmitted frequency.*

Advantages

- Better images with difficult-to-scan patients
- Increased contrast resolution
- Reduced effect of grating lobes

Limitations

- Best in mid-range depth – the specific depth range for which harmonic imaging works best depends on the transducer as well as other factors.
- Reduced penetration
- Reduced lateral resolution

To turn harmonic imaging on:

Make sure that B-mode imaging is turned on.

- Press [ ]

or

Click **Harmonic** under **General** on the left side of the screen and select **TEH**.

To turn harmonic imaging off:

- Press [ ]

or

- Click **Harmonic** under **General** on the left side of the screen.

  NOTE: *When you turn harmonic imaging off, B-mode scanning resumes with the frequency, gain, dynamic range and so on that you were using previously.*

Timer

You can start a timer to keep track of elapsed time. The time will be displayed on a saved or printed image.

To start the timer:

- Click **Timer** under **Image** on the right side of the screen.

or

- Press [x••••x].

  The timer starts running and the elapsed time replaces the word "**Timer**".

Position on image

The elapsed time is also displayed in the scan area of the screen under the color bar. This time is saved when you save or print the image. You can move the time to a new location on the image by clicking and dragging it.

NOTE: *When you freeze the image, the time on the image is frozen, but the time next to the green light keeps running. When you unfreeze the image, the time on the image is updated to be correct.*

To stop the timer:

- Click the time under **Image** on the right side of the screen.

or

- Press [x••••x].

  The time value in the scan area disappears. The time under **Image** on the right side of the screen is replaced by the word "**Timer"**.

Chapter 8
M-Mode

Overview

M-mode (motion mode) ultrasound is produced by slowly sweeping one line of a B-mode image across the screen. The M-mode image illustrates a time series of scans along this line.

M-mode can only be used in combination with B-mode.

To turn M-mode on or off:

- Press [M]

Selecting any other mode will also turn off M-mode.

To return to scanning with B-mode alone, press [B].

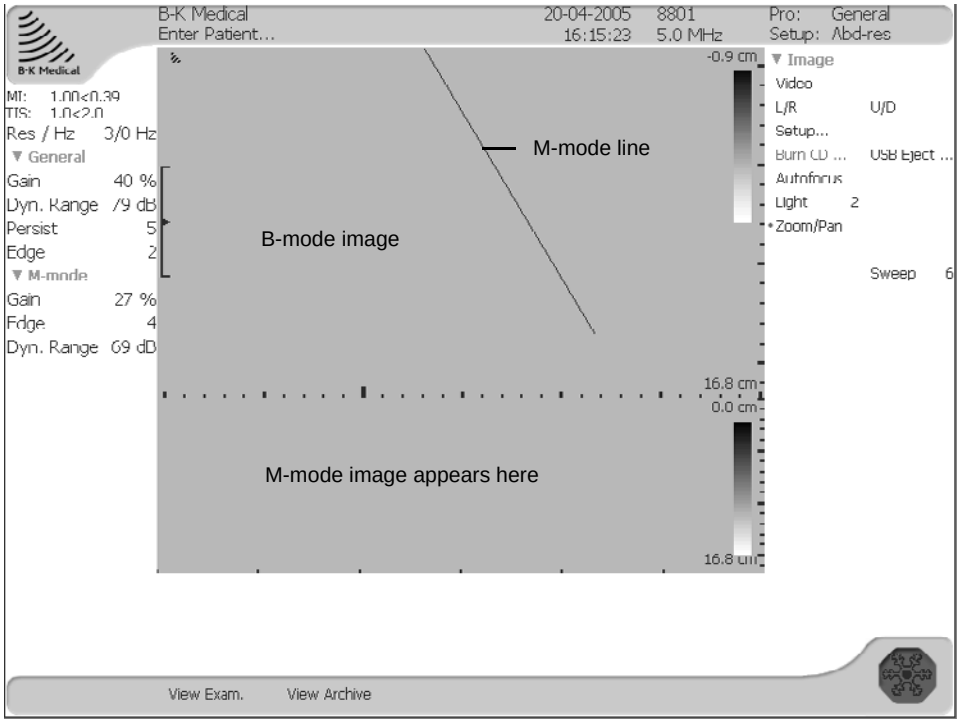


Figure 8-1. M-mode image.

The M-mode image

When M-mode is selected, the screen will be divided into two windows (see Fig 8-1). You can adjust how the two windows are displayed (See “Doppler and M-Mode Screen Layout” on page 169).

Adjusting the Scan Area

M-Mode Line

The M-mode line (see Fig 8-1) shows the path of the M-mode scan in the B-mode window. You can adjust the path of the scan by moving the M-mode line.

To adjust the M-mode line:

1. Select the M-mode line by clicking on it or press [↕].
2. Drag the line to the desired position.

M-Mode Image Ruler

The M-mode image ruler scales the ruler range of the B-mode image to the M-mode image. Any given value will represent the same position on both the M-mode and B-mode images.

It is not possible to change the ruler.

Sweep Speed

You can control the speed at which the M-mode image sweeps across the screen.

To adjust the sweep speed:

1. Click on sweep in the right side of the screen.
2. Drag to the desired value and click.

The available values range from 2 (slowest) to 8 (fastest).

Gain

To adjust the gain (brightness) of the scanned image, use a combination of the [**M/Doppler Gain**] and the [**TGC**] (Time Gain Control) sliders on the control panel.

M-Mode Gain

The [**M/Doppler Gain**] determines the overall amplification that is applied to ultrasound echoes.

To adjust the overall gain:

- Turn the [**M/Doppler Gain**] dial.

or

- Click **Gain** under **M-mode** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

The current overall gain setting (a percentage) is displayed on the screen next to **Gain**.

TGC

M-mode uses the same TGC settings as the B-mode image.

To adjust TGC in the M-mode image, you must work in the B-mode image (see “TGC” on page 121). The changes that you make to the B-mode image will be reflected in the M-mode image.

Focus

M-mode uses the same Focus settings as the B-mode image.

To adjust the focus in the M-mode image, you must work in the B-mode image (see “Focus” on page 122). The changes that you make to the B-mode image will be reflected in the M-mode image.

NOTE: *Only a single focal zone is possible in M-mode.*

Autofocus

Autofocus ensures that the center of the focal range is always centered in the displayed image.

To turn autofocus on or off:

- Click **Autofocus** on the right side of the screen.

  A small green light next to **Autofocus** indicates that the function is turned on.

Dynamic Range (Contrast)

You can adjust the dynamic range (contrast) of the ultrasound image from 50 to 90 dB.

To adjust dynamic range:

- Press [**Dyn Range** ◐] to increase or decrease the level

or

- Click **Dyn. Range** under **M-mode** on the left side of the screen and drag the slider (or point at **Dyn. Range** and press [**+/-**]).

The current dynamic range setting is displayed on the screen next to **Dyn. Range**.

Zoom

Zoom

Zoom does not work directly in the M-mode image. To zoom in or out on the area of the M-mode image that you are interested in you must adjust the zoom box in the B-mode image (see “Zoom” on page 123).

Panning

Panning does not work directly in the M-mode image. To pan in the M-mode image you must work in the B-mode image (see “Panning” on page 124). Any changes made to the B-mode image will be applied to the M-mode image

Edge Enhancement

Edge enhancement is a way of emphasizing contours so that edges stand out more clearly.

You can select the degree of edge enhancement of the M-mode image.

To adjust edge enhancement:

- Click **Edge** under **M-mode** on the left side of the screen and select the value you want (or point at **Edge** and press [**+/-**]).

  The available values range from 0 (no enhancement) to 7 (maximum enhancement).

  The current setting is displayed on the screen next to **Edge**.

M-mode Frequency – MFI

If an MFI (Multi-Frequency Imaging) transducer is selected, you can select the scanning (transmitted) frequency. The current scanning frequency is displayed at the top of the screen. M-mode uses the same MFI frequency as B-mode.

To select the scanning frequency:

- Press [**Frequency**] to step through the frequency options.

or

- Click the current scanning frequency (for example, **5.0 MHz** in Fig 8-1) in the Identification area of the screen and select the value you want (or point at the frequency and press [**+/-**]).

The view must be scanning when you do this.

M-Mode Gray Scale

Several gray scales can be used to display a M-mode image. Different gray scales may make various aspects of the image clearer.

To select the gray scale in M-mode:

- Click the gray scale bar to the right of the M-mode image and select the gray scale you want or point at the color bar and press [**+/-**]).

  The gray scale bar to the right of the M-mode image is replaced by the one you select.

Chapter 9
Color Mode – Color Flow Mapping

Overview

Color mode (CFM, color flow mapping, color Doppler) ultrasound displays color-coded real-time information about direction and velocity of flow in the tissues.

Color Flow Mapping

In a Color mode scan, the frequencies of the reflected ultrasound waves are measured to show the velocity and direction of the blood flow. The result is displayed in color on the screen.

Flow Direction	Default Color
Toward the transducer	Red
Away from the transducer	Blue

Table 9-1. Default color coding in Color mode.

It is possible to invert this color-coding or select a different one. (See “Invert” on page 143 or “Color Mapping” on page 143.)

Color mode can only be used in combination with B-mode. Whenever Color mode is active, a color box is superimposed on the B-mode image. The color box defines the area of the B-mode image for which flow information is available.

Submodes

Three submodes are available in Color mode scanning:

- Velocity
- Variance
- Velocity + Variance

You can select the submode you want. The view must be scanning when you do this.

To select the submode:

- Click **Submode** on the right side of the screen and select the submode you want.

  The current submode is displayed on the screen next to **Submode**.

  The color bar is updated to match the submode.

Adjusting the Thermal Index Limit

Before you use Color mode, check that the TI settings are appropriate. The current TI tissue type and limit are displayed just under the B-K Medical logo in the upper left corner of the screen.

The absolute TI limit for each tissue type is set by the factory to conform to FDA standards (see “Acoustic Output” on page 26), but you may want to set a lower TI limit for some purposes. There are 2 types of settings you can vary:

- Tissue type (TIS – soft tissue, TIC – cranial, TIB – bone)
- TI limit (not exceeding the factory-set limits)

To select tissue type:

- Click the **TI** type displayed and select **TIB**, **TIC** or **TIS** (or point at **TI** and press [**+/-**]).

To adjust the TI limit:

- Click the limit displayed after the TI type and select the value you want.

  The current TI is displayed as **TIx:z.z<y.y**, where x is S, C, or B; y.y is the limit you select; and z.z is the actual TI.

Adjusting MI

You can adjust the maximum allowed MI (mechanical index).

To adjust the MI limit:

- Click **MI** above **General** on the left side of the screen and drag the slider.

Turning Color Mode On or Off

When you turn on Color mode, B-mode must be scanning.

To turn on Color mode:

- Press [**Color**].

  The color box appears.

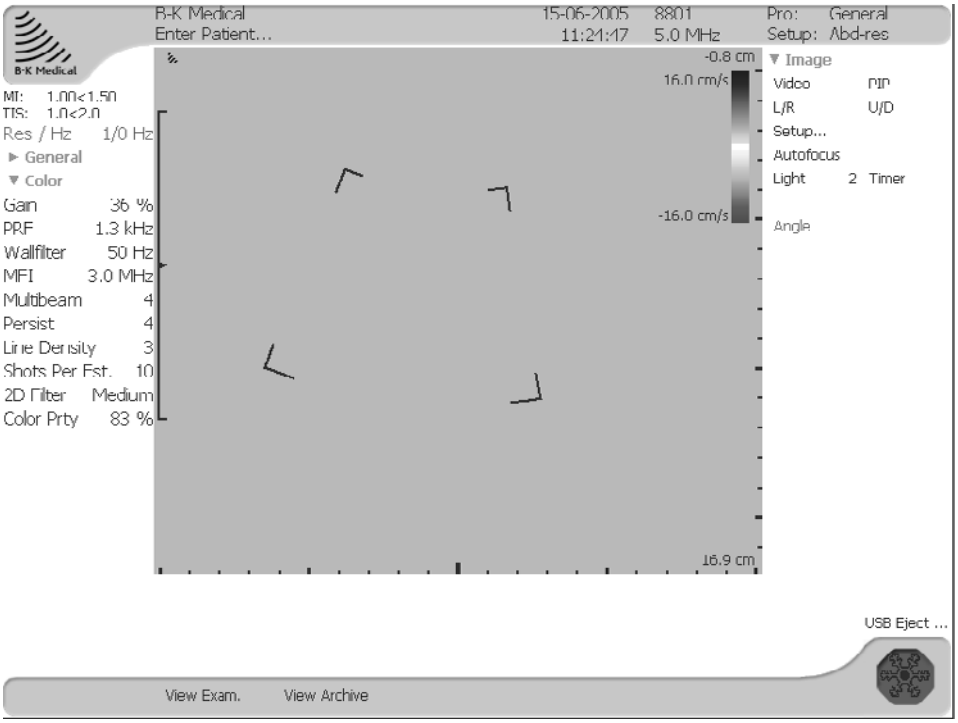


Figure 9-1. The Color mode color box superimposed on a B-mode image.

To turn off Color mode:

- Press [**Color**].

Adjusting the Color Mode Image

Color Box

When Color mode scanning is turned on, the color box is superimposed on the B-mode scan. The color box outlines the area of the tissue in which flow information is available.

You can adjust the size and position of the color box to examine flow in various parts of the B-mode image. The view must be scanning when you do this.

To resize the color box:

1. Point at the box or select it by clicking inside it or pressing [⎘].
2. Press [**+/-**].

or

- Click a corner of the box and drag the corner.

To move the color box:

- Click inside the box and drag the box.

Gain

You can adjust the gain of the Color mode image. The view must be scanning when you do this.

To adjust Color mode gain:

- Turn the [**Color/Power Gain**] dial.

or

- Click **Gain** under **Color** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

  The current Color gain setting (a percentage) is displayed on the screen next to **Gain**.

Range

You can vary the PRF (pulse repetition frequency) to select the range of Doppler velocities (frequencies) that are color-coded and displayed. Restricting the range allows you to see velocity differences (within the range) in more detail.

To adjust the velocity range:

- Press [**Scale** ↕] to step through the available ranges.

or

- Click **PRF** under **Color** on the left side of the screen and select the value you want (or point at **PRF** and press [**+/-**]).

  The color bar is updated to correspond to the new range of velocities.

  The current setting is displayed on the screen next to **PRF**.

Wall Filter

A wall filter is used to eliminate low-frequency artifacts such as Doppler shifts arising from respiratory and cardiac motion or movement of blood vessel walls. The wall filter cuts off all frequencies below the cutoff frequency. You can adjust the cut-of frequency.

To set the cutoff frequency for the wall filter:

- Click **Wall Filter** under **Color** on the left side of the screen and select the value you want (or point at **Wall Filter** and press [**+/-**]).

or

- Press [**Filter** ⊛] to step through the available values.

  The current setting is displayed on the screen next to **Wall Filter**.

Color Mode Frequency

If an MFI (Multi-Frequency Imaging) transducer is selected, you can select the Doppler scanning frequency as well as the B-mode scanning frequency. The view must be scanning when you do this.

To select the Color mode frequency:

- Press [**Frequency** ↘] to step through the frequency options.

or

- Click **MFI** under **Color** on the left side of the screen and select the value you want (or point at **MFI** and press [**+/-**]).

  The current value is displayed on the screen next to **MFI**.

  NOTE: *The current scanning frequency displayed at the top of the screen is always the B-mode frequency.*

Persistence

You can adjust the persistence level of the Color mode image. The view must be scanning when you do this.

To adjust Color mode persistence:

- Click **Persist** under **Color** on the left side of the screen and select the level you want (or point at **Persist** and press [**+/-**]).

  The available values range from 1 (no averaging) to 8 (maximum averaging).

  The current setting is displayed on the screen next to **Persist**.

Auto

Increasing the resolution of an ultrasound image results in a reduction in frame rate. The system can automatically adjust several parameters to give the best combination of resolution and frame rate.

In Auto, you can choose the priority given to resolution over frame rate (**Res/Hz**) from one of four options.

To turn Auto on and off:

- Press [**Auto** •]

  NOTE: *When Auto is turned on,* **Multibeam**, **Line Density** *and* **Shots Per Est.** *will be automatically set and will not be displayed on screen.*

To adjust the resolution:

- Click **Res/Hz** under **General** and select the resolution you want.

  The current setting is displayed on the screen next to **Res/Hz**.

Line Density

You can adjust the line density of the Color mode image. Increasing the line density decreases the frame rate. You get finer color resolution but a slower refresh rate. The view must be scanning when you do this

Line density is not available when Auto is turned on.

To adjust Color mode line density:

- Click **Line Density** under **Color** on the left side of the screen and select the value you want (or point at **Line Density** and press [**+/-**]).

  The available values range from 1 to 5.

  The current setting is displayed on the screen next to **Line Density.**

Color Quality – Shots per Estimate

One way to improve the accuracy of the color-coded velocity information is to increase the number of pulses transmitted in each waveform packet (shots per estimate) at the expense of decreasing the frame rate. The view must be scanning when you do this.

Shots Per Est. is not available when Auto is turned on.

To adjust the color quality (select shots per estimate):

- Click **Shots per Est.** under **Color** on the left side of the screen and select the value you want (or point at **Shots per Est.** and press [**+/-**]).

  The available values range from 4 to 16.

  The current setting is displayed on the screen next to **Shots per Est**.

2D Filter

Sometimes the color information in the image has an uneven appearance. A smoothing function can help even out the color information. You can set a 2D filter level to select the amount of color smoothing you want.

To set the 2D filter level:

- Click **2D Filter** under **Color** on the left side of the screen and select the value you want (**Off**, **Low**, **Medium** or **High**).

  The current setting is displayed on the screen next to **2D Filter**.

Color Priority

When color information is superimposed on a B-mode image, color can appear outside vessels, making it appear that the flow is not restricted to the vessel. To minimize this effect, you can adjust the color priority. Make the color priority lower to have less color outside the vessels.

To adjust the color priority:

- Click **Color Prty** under **Color** on the left side of the screen and drag the slider.

  The current setting is displayed on the screen next to **Color Prty**.

  NOTE: *High color priority gives color in more areas; low color priority reduces the number of areas that are colored.*

Invert

You can invert the way color is assigned to flow information so that flow towards the transducer appears blue and flow away from the transducer appears red.

To invert the color coding or to return to the default:

- Press [**Inverse**] to toggle between the default and inverted color coding.

  The color coding in the Color mode image inverts.

  The color bar to the right of the image is inverted to show the new color coding.

Color Mapping

Various color scales can be used to display a Color mode image.

To select the color scale in Color mode:

- Click the color bar to the right of the image and select the color scale you want.

  The color bar to the right of the image is replaced by the one you select.

  NOTE: *When you scan in Color mode, you cannot use the color bar to change the B-mode gray scale because it is used to control the Color mode color mapping.*

Multibeam

Multibeam is a method for increasing the frame rate by receiving signals from several directions (at the expense of resolution).

Multibeam is not available when Auto is turned on.

To select the multibeam level:

- Click **Multibeam** under **Color, More** on the left side of the screen and select the value you want (or point at **Multibeam** and press [**+/-**]).

The available values are 1 and 2.

The current setting is displayed on the screen next to **Multibeam**.

Baseline

The baseline is the point on the scale that separates forward flow from reversed flow. You can reposition it (offset the Doppler color scale) to help with aliasing problems.

To adjust the baseline:

- Press [**Baseline**] to move the baseline up or down.

  The color bar is updated.

  The frequency axis on the color bar is updated.

Steering

You can steer the Doppler beam of a linear transducer to vary the beam angle. This can be useful for examining flow in blood vessels parallel to the transducer surface.

To adjust the beam angle:

- Press [**Steer**]. You can choose left steering, right steering or no steering.

  The shape of the color box is adjusted on the screen to reflect the beam angle.

Chapter 10
Power Mode – Power Doppler

Overview

Power mode (power Doppler) ultrasound displays information about the number of particles moving, rather than their velocity. The signal strength (related to the square of the velocity) increases as the number of flowing particles increases. Thus the amplitude of the signal indicates the amount of blood present and flowing within a sample volume.

Power Doppler does not contain directional information, so you gain sensitivity at the expense of directional information.

Directional Power Doppler Directional power Doppler incorporates directional information into a power Doppler display – the directional information is retained. In effect, the power is calculated independently for the flow in each direction.

Power mode can only be used in combination with B-mode. Whenever Power mode is active, a color box is superimposed on the B-mode image. The color box defines the area of the B-mode image for which flow information is available.

Submodes

Two submodes are available in Power mode scanning:

- Power (power Doppler)
- Power + Velocity (directional power Doppler)

You can select the submode you want. The view must be scanning when you do this.

To select the submode:

- Click **Submode** on the right side of the screen and select the submode you want.

  The current submode is displayed on the screen next to **Submode**.

  The color bar is updated to match the submode.

Adjusting the Thermal Index Limit

Before you use Power mode, check that the TI settings are appropriate. The current TI tissue type and limit are displayed just under the B-K Medical logo in the upper left corner of the screen.

For information about adjusting the TI, see “Adjusting the Thermal Index Limit” on page 138.

Adjusting MI

You can adjust the maximum allowed MI (mechanical index).

To adjust the MI limit:

- Click **MI** above **General** on the left side of the screen and drag the slider.

Turning Power Mode On or Off

When you turn on Power mode, B-mode must be scanning.

To turn on Power mode:

- Press [**Power**].
  The color box appears.

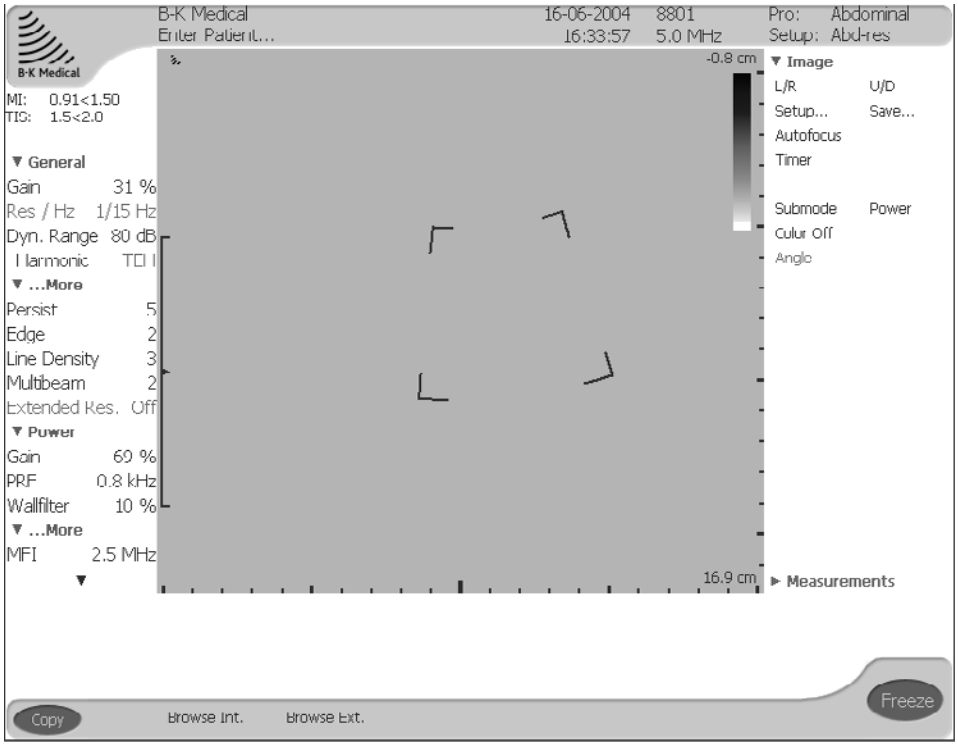


Figure 10-1. The Power mode color box superimposed on a B-mode image.

To turn off Power mode:

- Press [**Power**].

Adjusting the Power Mode Image

Color Box

The color box outlines the area of the tissue in which flow information is available.

For information about adjusting the size and position of the color box, see “Color Box” on page 139. The view must be scanning when you adjust the color box.

To resize the color box:

1. Point at the box or select it by clicking inside it or pressing [⎘].
2. Press [**+/-**].

or

- Click a corner of the box and drag the corner.

To move the color box:

- Click inside the box and drag the box.

Gain

You can adjust the gain of the Power mode image. The view must be scanning when you do this.

To adjust Power mode gain:

- Turn the [**Color/Power Gain**] dial.

or

- Click **Gain** under **Power** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

  The current Power gain setting (a percentage) is displayed on the screen next to **Gain**.

Range

As in Color mode, you can vary the PRF (pulse repetition frequency) to select the range of velocities (frequencies) that are color-coded and displayed. The range must be carefully adjusted to filter out movement of the vessels and avoid aliasing.

To adjust the velocity range:

- Press [I] to step through the available ranges.

or

- Click **PRF** under **Power** on the left side of the screen and select value you want (or point at **PRF** and press [**+/-**]).

The current setting is displayed on the screen next to **PRF**.

Wall Filter

As in Color mode, you can set the cutoff frequency for the wall filter.

To set the cutoff frequency for the wall filter:

- Click **Wall Filter** under **Power** on the left side of the screen and select the value you want (or point at **Wall Filter** and press [**+/-**]).

or

- Press [**Filter** ⊛] to step through the available values.

  The current setting is displayed on the screen next to **Wall Filter**.

Power Mode Frequency

As in Color mode, if an MFI (Multi-Frequency Imaging) transducer is selected, you can select the Doppler scanning frequency as well as the B-mode scanning frequency. The view must be scanning when you do this.

To select the Power mode frequency:

- Press [**Frequency** ↘] to step through the frequency options.

or

- Click **MFI** under **Power** on the left side of the screen and select the value you want (or point at **MFI** and press [**+/-**]).

  The current value is displayed on the screen next to **MFI**.

  NOTE: *The current scanning frequency displayed at the top of the screen is always the B-mode frequency.*

Persistence

You can adjust the persistence level of the Power mode image. The view must be scanning when you do this.

To adjust Power mode persistence:

- Click **Persist** under **Power** on the left side of the screen and select the level you want (or point at **Persist** and press [**+/-**]).

  The available values range from 1 (no averaging) to 8 (maximum averaging).

  The current setting is displayed on the screen next to **Persist**.

Auto

Increasing the resolution of an ultrasound image results in a reduction in frame rate. The system can automatically adjust several parameters to give the best combination of resolution and frame rate.

In Auto, you can choose the priority given to resolution over frame rate (**Res/Hz**) from one of four options.

To turn Auto on and off:

- Press [**Auto**]

  NOTE: *When Auto is turned on,* **Multibeam**, **Line Density** *and* **Shots Per Est.** *will be automatically set and will not be displayed on screen.*

To adjust the resolution:

- Click **Res/Hz** under **General** and select the resolution you want.

  The current setting is displayed on the screen next to **Res/Hz**.

Line Density

You can adjust the line density of the Power mode image. Increasing the line density decreases the frame rate. You get finer color resolution but a slower refresh rate. The view must be scanning when you do this.

Line density is not available when Auto is turned on.

To adjust Power mode line density:

- Click **Line Density** under **Power**, **More** on the left side of the screen and select the value you want (or point at **Line Density** and press [**+/-**]).

  The available values range from 1 to 5.

  The current setting is displayed on the screen next to **Line Density.**

Color Quality – Shots per Estimate

As in Color mode, you can increase the number of pulses transmitted in each waveform packet (shots per estimate) at the expense of decreasing the frame rate. The view must be scanning when you do this.

Shots per Est. is not available when Auto is turned on.

To adjust the color quality (select shots per estimate):

- Click **Shots per Est.** under **Power**, **More** on the left side of the screen and select the value you want (or point at **Shots per Est.** and press [**+/-**]).

  The available values range from 4 to 16.

  The current setting is displayed on the screen next to **Shots per Est**.

2D Filter

Sometimes the color information in the image has an uneven appearance. A smoothing function can help even out the color information. You can set a 2D filter level to select the amount of color smoothing you want.

To set the 2D filter level:

- Click **2D Filter** under **Power** on the left side of the screen and select the value you want (**Off**, **Low**, **Medium** or **High**).

  The current setting is displayed on the screen next to **2D Filter**.

Color Priority

When color information is superimposed on a B-mode image, color can appear outside vessels, making it appear that the flow is not restricted to the vessel. To minimize this effect, you can adjust the color priority. Make the color priority lower to have less color outside the vessels.

To adjust the color priority:

- Click **Color Prty** under **Power** on the left side of the screen and drag the slider.

  The current setting is displayed on the screen next to **Color Prty**.

  NOTE: *High color priority gives color in more areas; low color priority reduces the number of areas that are colored.*

Invert

In the Power+Velocity submode, as in Color mode, you can invert the way color is assigned to velocity flow information.

To invert the color coding or to return to the default:

- Press [**Inverse**] to toggle between the default and inverted color coding.

  The color coding of the velocity information inverts.

  The velocity color bar to the right of the image is inverted to show the new color coding.

Color Mapping

Various color scales can be used to display a Power mode image. The color bar is different in the 2 submodes. In Power + Velocity, the bar is vertical but the intensity changes in the horizontal direction.

To select the color scale in Power mode:

- Click the color bar to the right of the image and select the color scale you want.

The color bar to the right of the image is replaced by the one you select.

NOTE: *When you scan in Power mode, you cannot use the color bar to change the B-mode gray scale because it is used to control the Power mode color mapping.*

Multibeam

Multibeam is a method for increasing the frame rate by receiving signals from several directions (at the expense of resolution).

Multibeam is not available when Auto is turned on.

To select the multibeam level:

- Click **Multibeam** under **Power, More** on the left side of the screen and select the value you want (or point at **Multibeam** and press [**+/-**]).

  The available values are 1 and 2.

  The current setting is displayed on the screen next to **Multibeam**.

Baseline

In the Power+Velocity submode, as in Color mode, you can reposition the baseline.

To adjust the baseline:

- Press [**Baseline** ↕] to move the baseline up or down.

  The color bar is updated.

  The frequency or velocity axis on the velocity color bar is updated.

Steering

As in Color mode, you can steer the Doppler beam of a linear transducer.

To adjust the beam angle:

- Press [**Steer** ⇲]. You can choose left, right or no steering.

  The shape of the color box is adjusted on the screen to reflect the beam angle.

Chapter 11
Doppler Mode – Spectral Doppler

Overview

Doppler mode (spectral Doppler mode) scanning displays information about the spectrum of flow velocities as a function of time. It is sometimes called FFT (Fast Fourier Transform) because the information is presented as a frequency spectrum indicating velocity components.

Pulsed Wave Doppler (PW)

PW Doppler is the primary Doppler mode. In PW Doppler, short bursts (pulses) of ultrasound waves are transmitted at regular intervals and analyzed as they return. The received signals are detected and sent to amplifiers for audio output as well as displayed on the screen for a visual presentation of the frequency components.

Adjusting the Thermal Index Limit

Before you use Doppler mode, check that the TI settings are appropriate. The current TI tissue type and limit are displayed just under the B-K Medical logo in the upper left corner of the screen.

For information about adjusting the TI, see “Adjusting the Thermal Index Limit” on page 138.

Adjusting MI

You can adjust the maximum allowed MI (mechanical index).

To adjust the MI limit:

- Click **MI** above **Gain** on the left side of the screen and drag the slider.

Turning Doppler Mode On or Off

When you turn on Doppler mode, B-mode must be scanning.

To turn on Doppler mode:

- Press [ ].

  The Doppler indicator, including both the Doppler line and the Doppler gate, appears superimposed on the B-mode image and the Doppler spectrum appears.

To position the Doppler gate on a larger B-mode image, press [ ] and position the Doppler gate before you press [ ].

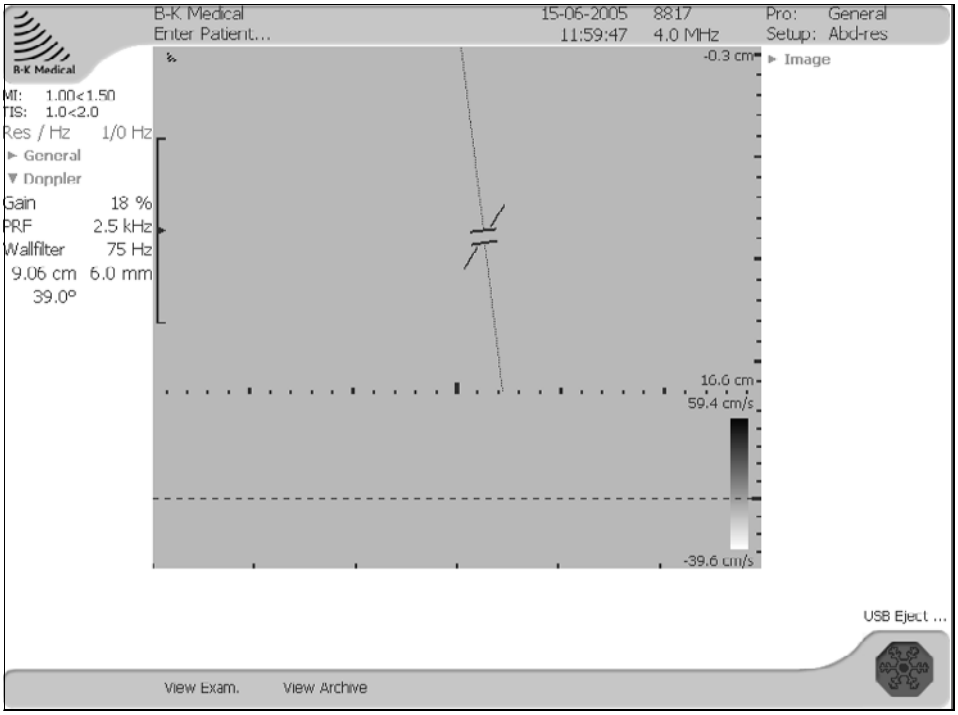


Figure 11-1. The Doppler indicator (line and gate) superimposed on a B-mode image.

The dotted line represents the Doppler line. The lines at right angles to that show the Doppler gate.

Fig 11-2 shows information available in Doppler indicators.

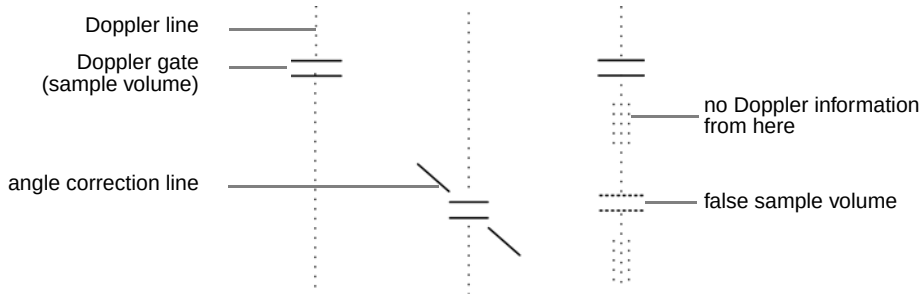


Figure 11-2. Doppler indicators (three examples).

A diagonal line (relative to the Doppler line) indicates a sample volume with angle correction (see “Angle Correction” on page 156). The thick lines are areas in which no Doppler information is available and the horizontal dotted lines show the false sample volume in HPRF (see page 157).

To turn off Doppler mode:

- Press [ ] or [B].

Audio Volume

The Doppler signal can be played as an audio signal as well as appearing on the screen.

To adjust the volume of the audio signal:

- Press [**Sound**].

Adjusting the Doppler Mode Image

Doppler Indicator

When Doppler mode scanning is turned on, the Doppler indicator is superimposed on the B-mode scan.

You can adjust the position and size of the Doppler gate to get information from sample volumes in various parts of the B-mode image. The view must be scanning when you do this.

Sample volume position

To move the Doppler gate:

- Click **cm** on the left side of the screen and drag to the desired value.

or

- Click the Doppler indicator or press [↕], and drag the gate.

  The sample volume line moves along with the gate.

Sample volume size

To resize the Doppler gate:

- Click **mm** on the left side of the screen and drag to the desired value.
- Point at the Doppler indicator, (or click it, or press [↕]) and then press [**+/-**].

Trace Overlay

Trace overlay displays a mean, peak or combination peak/mean velocity trace in the Doppler image.

To turn on or to change the trace overlay:

- Click on **Trace** on the right side of the screen and select the desired mode from the drop down menu.

Steering

As in Color mode, you can steer the Doppler beam of a linear transducer.

To adjust the beam angle:

- Press [**Steer**]. You can choose left, right or no steering.

The angle of the Doppler line and Doppler gate are adjusted on the screen to reflect the beam angle.

Angle Correction

You can apply an angle to the volume used for Doppler measurement. This makes the Doppler spectrum be displayed in cm/sec instead of kHz.

To turn angle correction on or off:

- Click **Angle** on the right side of the screen

or

- Press [**On**].

  The angle correction line is superimposed on the Doppler gate.

To adjust the angle correction:

- Select the angle correction line by clicking on it or by turning it on (see above), and rotate it to the position you want using the trackball.

or

- Click the angle correction value (degrees) under **Doppler** on the left side of the screen and drag the slider (or point at the value and press [**+/-**]).

or

- Press and hold [**Angle**] until the desired value is reached.

  NOTE: *The value will stop at +/- 60 degrees. Release* [**Angle**] *and press again to adjust the angle further.*

The current setting (in degrees) is displayed at the bottom of the list under **Doppler** on the left side of the screen.

Gain

You can adjust the gain of the Doppler mode image. The view must be scanning when you do this.

To adjust Doppler mode gain:

- Turn the [**M/Doppler Gain**] dial.

or

- Click **Gain** under **Doppler** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

  The current Doppler gain setting (a percentage) is displayed on the screen next to **Gain**.

Range

In Doppler mode, as in Color mode, you can vary the PRF (pulse repetition frequency) to select the range of Doppler frequencies that are included in the spectral analysis.

To adjust the velocity range:

- Press [**Scale** ↕] to step through the available ranges.

or

- Click **PRF** under **Doppler** on the left side of the screen and select the value you want (or point at **PRF** and press [**+/-**]).

  The vertical scale is updated to correspond to the new range of velocities.

  The current setting is displayed on the screen next to **PRF**.

  Note: The wall filter value will be changed automatically when you change the PRF value.

HPRF

To measure higher flow speeds (high range setting) in a sample volume placed deep in the tissue, HPRF (high PRF) is automatically used. When HPRF is active, the Doppler line shows the actual sample volume, false sample volumes (indicated by holes in the line), and dead space areas where Doppler information cannot be achieved at the current PRF (indicated by a thick line). See Fig 11-2 on page 154.

The false sample volumes should always be placed outside a vessel. The “thick” parts of the line (see Fig 11-2 on page 154) can be moved by adjusting the range.

When HPRF is used and the actual sample volume is placed in a dead space, the system automatically adjusts the range so that the signal can be received.

Wall Filter

In Doppler mode, you can set the cutoff frequency for the wall filter.

To set the cutoff frequency for the wall filter:

- Click **Wall Filter** under **Doppler** on the left side of the screen and select the value you want (or point at **Wall Filter** and press [**+/-**]).

or

- Press [**Filter** ⊛] to step through the available values.

  The current setting is displayed on the screen next to **Wall Filter**.

Invert

In PW Doppler mode, you can invert the spectrum on the screen.

To invert the spectrum or to return to the default:

- Press [**Inverse**] to toggle between the default and inverted color coding.

  The frequency axis is inverted to match the spectrum.

Baseline

In Doppler mode, you can reposition the baseline. The baseline separates forward flow from reversed flow, and moving the axis can help overcome aliasing problems.

To adjust the baseline:

- Press [**Baseline** ↕] to move the baseline up or down.

  The frequency axis is updated to match the spectrum.

Sweep Speed

You can adjust the sweep speed to change the number of cycles of the spectrum displayed on the full time axis. The available values range from 2 (slowest) to 8 (fastest).

To select the sweep speed:

- Click **Sweep** on the right side of the screen and select the required value (or point at **Sweep** and press [**+/-**]).

  The current setting is displayed on the screen next to **Sweep**.

  The time axis is updated.

Chapter 12
Continuous Wave Doppler Mode

Overview

In Continuous Wave (CW) Doppler, ultrasound is transmitted as a continuous wave and analyzed as it returns. CW Doppler provides greater sensitivity when measuring high flow regions such as near the heart.

Adjusting the Thermal Index Limit

Before you use CW Doppler mode, check that the TI settings are appropriate. The current TI tissue type and limit are displayed just under the B-K Medical logo in the upper left corner of the screen.

For information about adjusting the TI, see “Adjusting the Thermal Index Limit” on page 138.

Adjusting MI

You can adjust the maximum allowed MI (mechanical index).

To adjust the MI limit:

- Click **MI** above **Gain** on the left side of the screen and drag the slider.

Turning CW Doppler Mode On or Off

When you turn on CW Doppler mode, B-mode must be scanning.

To turn on Doppler mode:

- Press [**CW**].

  The CW Doppler Sample Region appears superimposed on the B-mode image.

To position the CW Doppler Sample Region on a larger B-mode image, press [ ] and position the CW Doppler indicator before you press [**CW**].

To turn on CW Doppler Spectrum:

- Press [ ]

  Note: The B-mode image and the CW Spectrum cannot be active at the same time.

To switch between live B-mode and live CW Doppler mode

- Press [ ].

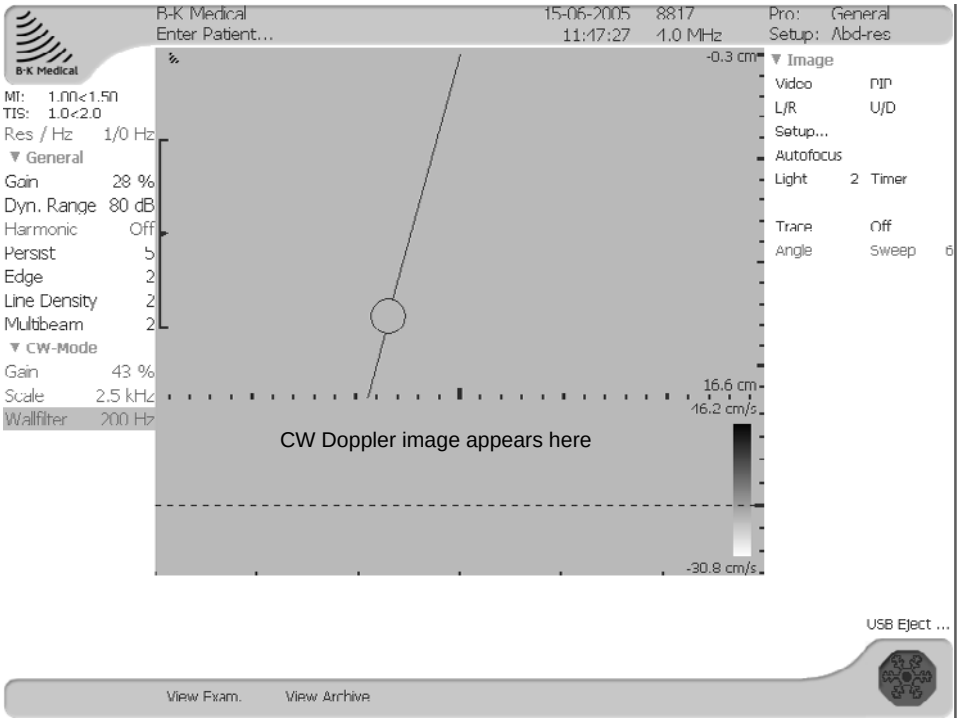


Figure 12-1. The CW Doppler indicator (line and sample region) superimposed on a B-mode image.

CW Doppler Sample Region

The CW Doppler Sample Region is the area where the Doppler focusing is concentrated. When CW Doppler is turned on the CW Doppler Sample Region indicator is superimposed on the B-mode scan.

Fig 12-2 shows information available in Doppler indicators.

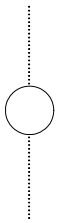


Figure 12-2. CW Doppler Sample Region indicator.

The dotted line represents the CW Doppler line. The circle indicates the CW Doppler Sample Region.

To turn off CW Doppler mode:

- Press [**CW**] or [B].

Audio Volume

The CW Doppler signal can be played as an audio signal as well as appearing on the screen.

To adjust the volume of the audio signal:

- Press [**Sound**].

Adjusting the Doppler Mode Image

CW Doppler Sample Region

When CW Doppler mode scanning is turned on, the CW Doppler Sample Region indicator is superimposed on the B-mode scan.

You can adjust the position of the sample region to get information from sample volumes in various parts of the B-mode image. The system must be scanning when you do this.

To move the CW Doppler Sample Region:

1. Select CW Doppler Sample Region by clicking on it or by pressing [↕].
2. Drag to the desired position (or press [**+/-**] to move the sample region).

Trace Overlay

Trace overlay displays a mean, peak or combination peak/mean velocity trace in the CW Doppler image.

To turn on or to change the trace overlay:

- Click on **Trace** on the right side of the screen and select the desired mode from the drop down menu.

Gain

You can adjust the gain of the CW Doppler mode image. The view must be scanning when you do this.

To adjust CW Doppler mode gain:

- Turn the [**M/Doppler Gain**] dial.

or

- Click **Gain** under **Doppler** on the left side of the screen and drag the slider (or point at **Gain** and press [**+/-**]).

  The current Doppler gain setting (a percentage) is displayed on the screen next to **Gain**.

Wall Filter

In CW Doppler mode, you can set the cutoff frequency for the wall filter.

To set the cutoff frequency for the wall filter:

- Click **Wall Filter** under **Doppler** on the left side of the screen and select the value you want (or point at **Wall Filter** and press [**+/-**]).

or

- Press [**Filter**] to step through the available values.

  The current setting is displayed on the screen next to **Wall Filter**.

Invert

In CW Doppler mode, you can invert the spectrum on the screen.

To invert the spectrum or to return to the default:

- Press [**Inverse**] to toggle between the default and inverted color coding.

  The frequency axis is inverted to match the spectrum.

Baseline

In CW Doppler mode, you can reposition the baseline. The baseline separates forward flow from reversed flow, and moving the axis can help overcome aliasing problems.

To adjust the baseline:

- Press [**Baseline**] to move the baseline up or down.

  The frequency axis is updated to match the spectrum.

Sweep Speed

You can adjust the sweep speed to change the number of cycles of the spectrum displayed on the full time axis.

To select the sweep speed:

- Click **Sweep** on the right side of the screen and select the submode you want (or point at **Sweep** and press [**+/-**]).

  The current setting is displayed on the screen next to **Sweep**.

  The time axis is updated.

Part 4: Setting up and Maintaining Your System

Chapter 13
Setting Up and Customizing Your System

The Pro Focus comes with many default setups that have been created to optimize the ultrasound images and make it easy for you to use the different transducers, Pro Packages and Diagnostic Setups. You can customize the system so that it is easy to enter and select exactly the information you need, and so that the default setups are the way you want them.

Pro Package and Diagnostic Setup

You can customize the Pro Packages and Diagnostic Setups to suit your needs.

To open the setup window for Pro Packages and Diagnostic Setups:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Pro/Setup** tab.

   The **Pro Package Setup** window appears.

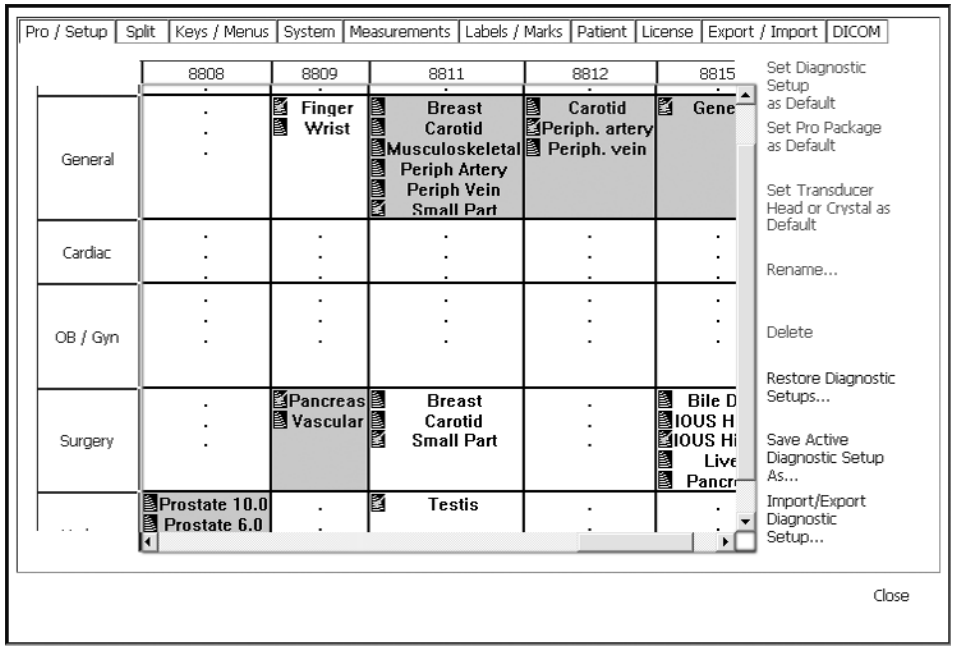


Figure 13-1. The Pro Package Setup window.

Each column in the window describes a transducer. Each row describes a Pro Package. Each cell contains a list of the Diagnostic Setups that are available for a particular transducer in a particular Pro Package. You can scroll up and down and from side to side to see all the cells in the table.

In this window, you can:

- choose the Pro Package that is the default for each transducer. The default is highlighted in blue in the table.
- choose the Diagnostic Setup that is the default for each transducer. This can be different for each Pro Package. The default is marked with a check mark.
- set a transducer head as default (for transducers with more than one head).
- rename or delete a Diagnostic Setup.
- restore factory default Diagnostic Setups. If you click this, a table appears for you to select the ones you want to restore.
- save the active Diagnostic Setup with a name you choose.
- import or export Diagnostic Setups.

Importing or Exporting Diagnostic Setups

You can export Diagnostic Setups to a flash memory device or CD and then import them to another Pro Focus scanner.

After a software upgrade, you must import Diagnostic Setups you have created or modified back into the system.

NOTE: *You must have a transducer connected when you import or export Diagnostic Setups.*

To import or export:

- In the **Pro Package Setup** window, click **Import/Export Diagnostic Setup.**

  The **Import/Export Diagnostic Setup** window appears.

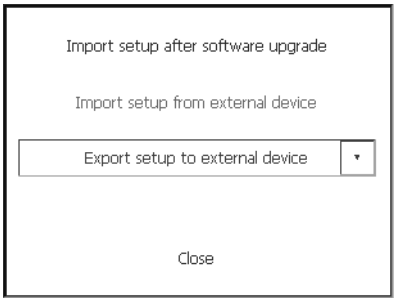


Figure 13-2. The Import/Export Diagnostic Setup window.

If you choose either type of import, a list of all the setups you can import will appear. You can select the ones you want to import.

If you choose to export, click the triangle to the right, then choose whether you want to export to a CD or a flash memory device.

NOTE: *If you export to a flash memory device, make sure that it is not set to be write-protected.*

Doppler and M-Mode Screen Layout

When you scan in Doppler or M-mode, a B-mode image is also present on the screen.You use the **Screen Layout Setup** window to specify the screen layout:

- The split between the modes can be vertical or horizontal.
- The size of the Doppler or M-mode image can be small, medium or large.

To open Screen Layout Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Split** tab.

   The **Screen Layout Setup** window appears.

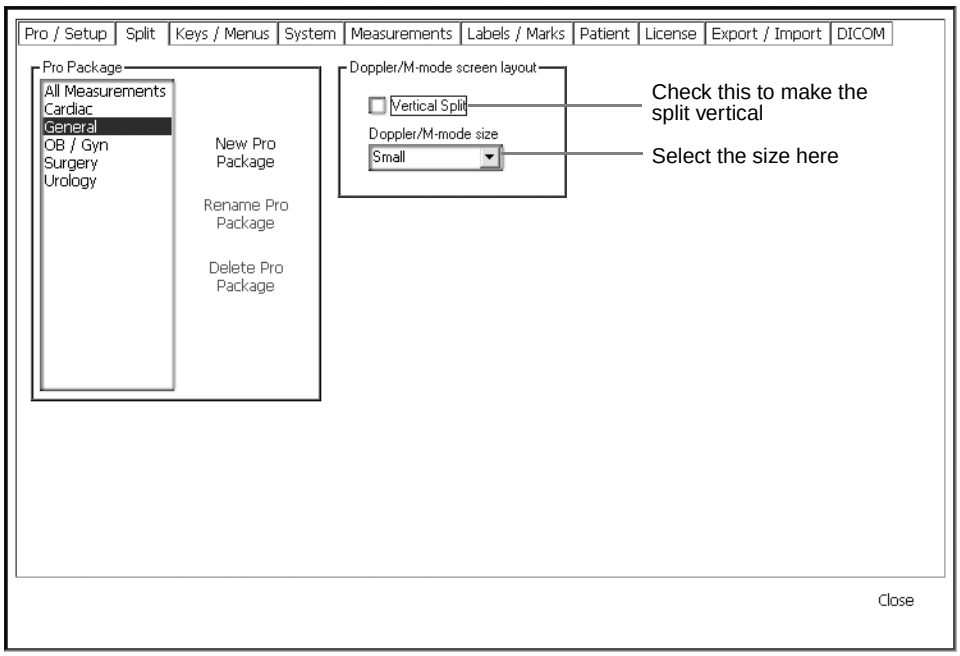


Figure 13-3. The Screen Layout Setup window.

User-Defined Keys

You can assign functions you commonly use to one of the many user-definable keys on the scanner keyboard panel and optional PCU as well as the foot-switch pedals. You can also assign some functions to a long press on the buttons on the transducers themselves. The same key can have different functions in different Pro Packages.

To open the Key Assignment Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various Setup windows.
2. Click the **Key Assignments** tab.

   The **Key Assignment Setup** window opens with a list of Pro Packages on the left and a list of the user-definable keys on the right.

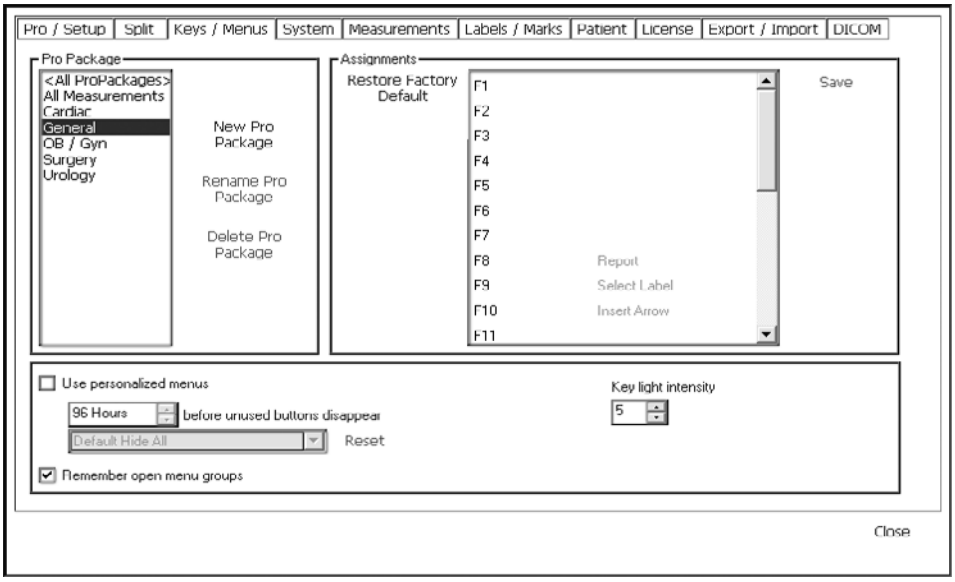


Figure 13-4. The Key Assignment Setup window.

Assigning User-Defined Keys

To assign functions to the user-defined keys and foot-switch pedals:

1. On the left side of the **Key Assignment Setup** window, click the Pro Package you want. (If you click **<All Pro Packages>**, the key assignment will be valid for all Pro Packages.)
2. On the right side, click the name of the key you want to define.
3. Click the ▼ that appears to the right to see a drop-down menu of the possible functions that you can assign to the key.
4. Click the one you want.
5. Repeat 2 through 4 until you have defined as many keys as you want.
6. Click **Save**.

Customizing Menus

In the **Key Assignment Setup** window, you can also specify whether you want to use personalized menus. This means you can specify how long unused menu options (buttons) remain on the screen. (You can always see them again by clicking the arrow next to the menu heading.)

To reset the system so that most options are hidden or so that all are displayed, select **Default Hide All** or **Default Show All** in the field next to **Reset** and then click **Reset**.

- **Default Hide All** – hides all options that can be hidden. Options are displayed again when they have been used.
- **Default Show All** – displays all options that are currently hidden because they have not been used recently. Items are hidden again when not used for a period of time.

You can also specify whether you want the scanner to remember which menu groups you have open.

In this window, you can also adjust the brightness of the key labels on the control panel.

System Setup

The **General Setup**, **Clip Storage Setup, 3D Setup, Printer Setup, Password Setup** and **Version Information** windows are grouped under the **System** tab. The **Version Information** window contains information about the scanner hardware and software. The other windows are described below.

General Setup

You use the **General Setup** window to change hospital name, language, video output format, date and time. You can also reset the system to the factory default setup in this window.

Hospital Name

The hospital name is displayed above the patient name at the top of the screen. It appears in all documentation of the image. You set or change the hospital name in the **General Setup** window.

To open the General Setup window**:**

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **System** tab, and then, in the new window that appears, the **General** tab.

   The **General Setup** window opens.

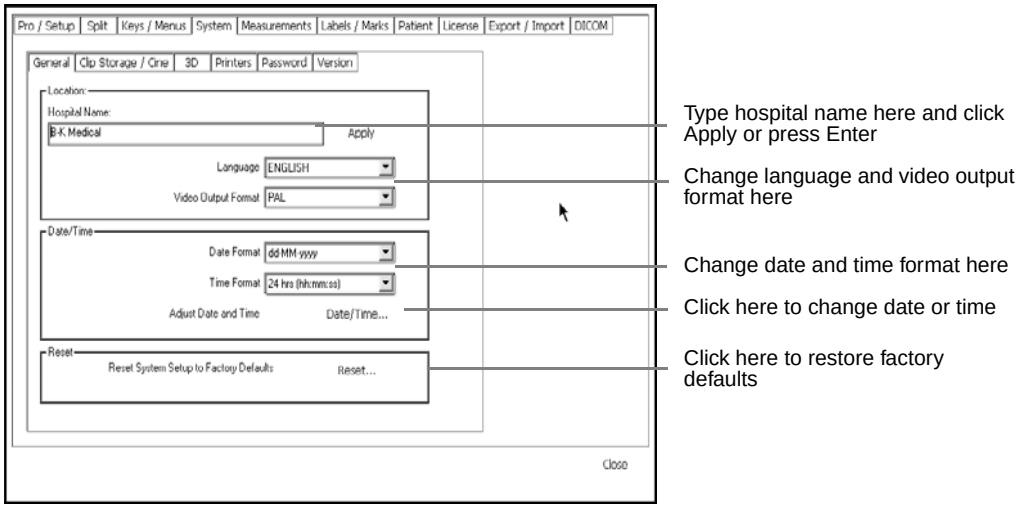


Figure 13-5. The General Setup window.

Language

Texts on the screen can be displayed in different languages. You can change the language in the **General Setup** window. See Fig 13-5.

> **NOTE:** *The language you select must be installed on the system. Otherwise your selection has no effect. The change of language will not take effect until you restart the scanner.*

Video Format

You can select PAL or NTSC for video output. The selection also specifies the format of the video source for using the video window or PiP. See “The Video Window and Picture in Picture (PiP)” on page 82.

Date/Time

You can change the date and time in the usual Microsoft® Windows® **Date/Time Properties** setup window. You cannot change existing time stamps.

Change date or time

To change the date or time:

- Click **Date/Time** in the **General Setup** window. See Fig 13-5.

  A message appears, stating that existing time stamps cannot be changed. When you accept the statement, the **Date/Time Properties** window appears.

Change date or time format

To change the date or time format:

- Select the date or time format in the **General Setup** window. See Fig 13-5.

Restoring the Factory Setup

To restore the factory default settings on the scanner, click **Reset** in the **General Setup** window. See Fig 13-5.

Clip Storage and Cine Setup

You can use the **Clip Storage and Cine Setup** window to change ways in which the clip browser and cine functions work.

To open the Clip Storage and Cine Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **System** tab and then the **Clip Storage/Cine** tab.

   The **Clip Storage Setup** window opens.

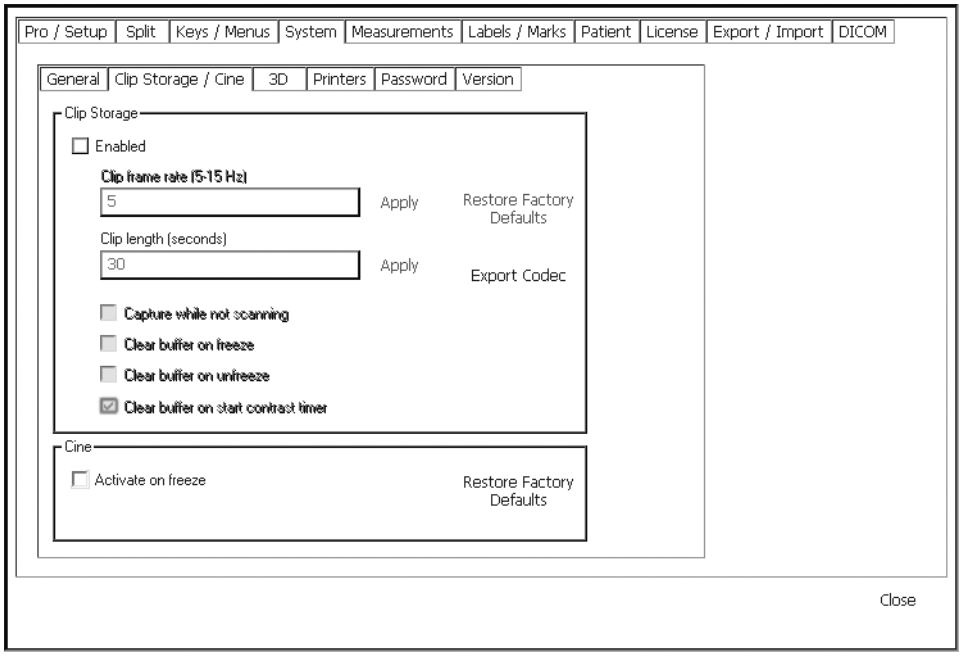


Figure 13-6. The Clip Storage Setup window.

Clip Storage and Cine Options

Clip frame rate	Sets the frame rate (from 5–15 Hz) that clips are captured with. Click **Apply** after you type a frame rate in the field.
Clip length	Sets the length of clips that are stored (in seconds). The maximum possible length depends on the frame rate you have set. Click **Apply** after you type a clip length in the field.
Capture while not scanning	Check this if you want to be able to capture clips while the image is frozen.
Clear buffer on freeze	Check this to have the clip buffer cleared when you freeze the image.
Clear buffer on start contrast timer	Check this if you want the clip buffer to be cleared when you start the timer.
Restore Factory Defaults	Restores factory default clip storage settings.
Export Codec	Exports the Clip Storage codec to a CD or USB device.
Activate on Freeze	Check this to have the Cine function start when you freeze the image.

Table 13-1. Settings in the Clip Storage Setup window.

3D Setup

You can specify whether the 3D system prompts you before deleting or overwriting user views and presets. You do this in the **3D Setup** window.

To open the 3D Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **System** tab, and then, in the new window that appears, the **3D** tab.
   The **3D Setup** window opens.

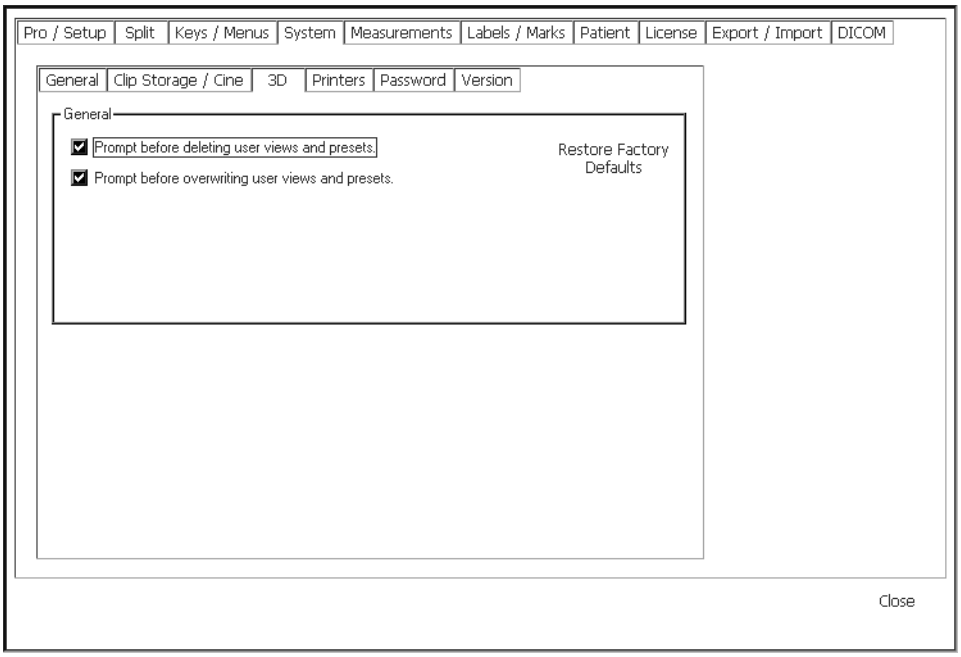


Figure 13-7. The 3D Setup window.

Check the boxes to have the system prompt you before deleting or overwriting user views.

Printer Setup

You can set up the paper size for your printers in the **Printer Setup** window.

To open the Printer Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **System** tab, and then, in the new window that appears, the **Printers** tab.

   The **Printer Setup** window opens.

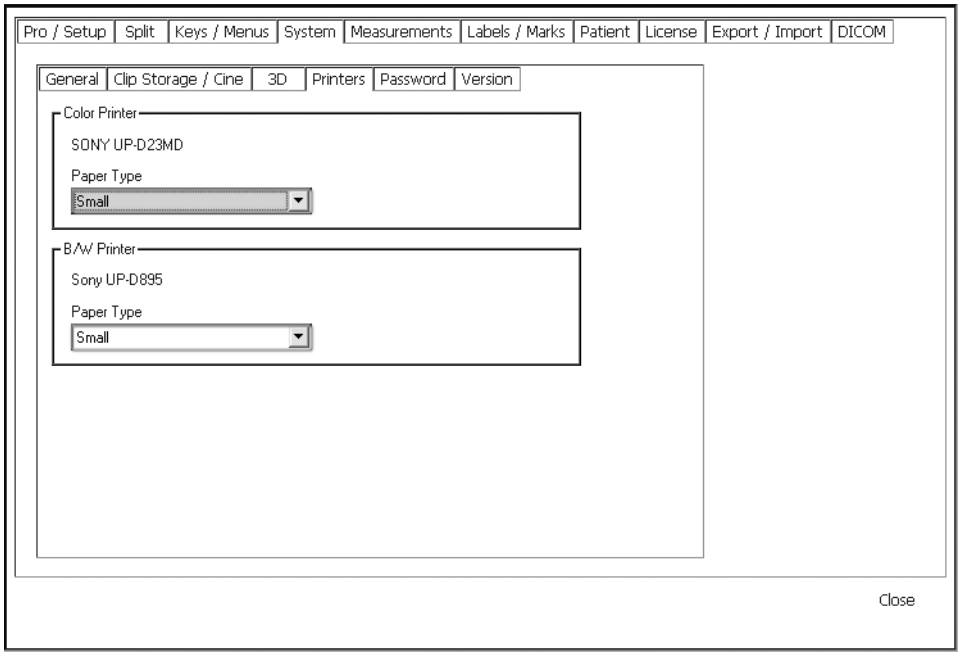


Figure 13-8. The Printer Setup window.

Password Setup

If your scanner is set up to be password-protected, you use the **Password Setup** window to change your password. If you are a superuser with administrative privileges, you can add or remove users, reset their passwords and enable or disable password protection.

The default superuser name and password are:

- Name: **`administrator`**
- Password: **`superuser`**

To open the Password Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **System** tab and then the **Password** tab.

   The **Password Setup** window opens.

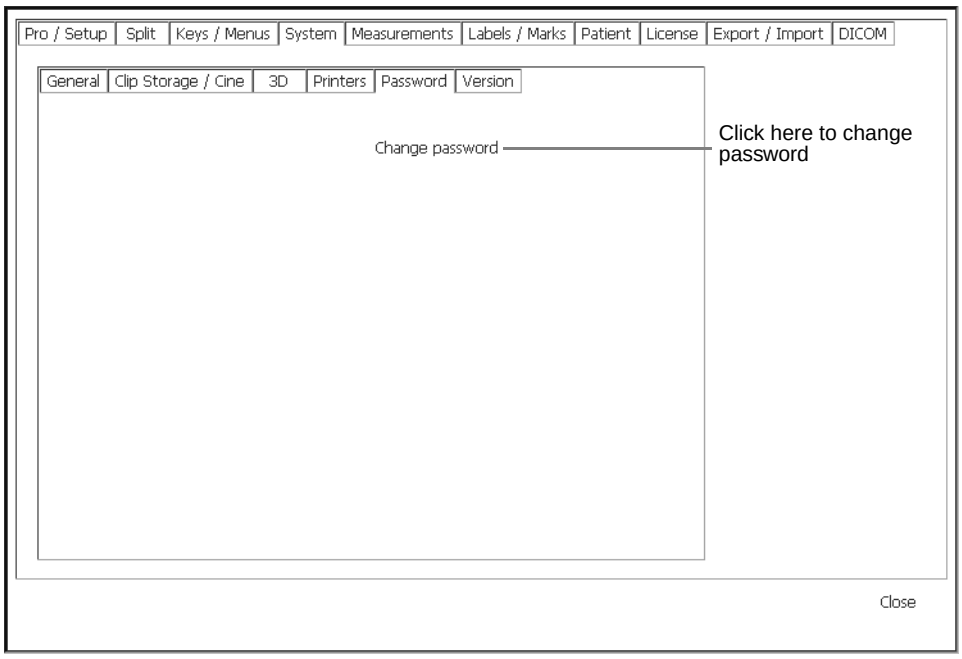


Figure 13-9. The Password Setup window for changing your password.

You can use the **Password Setup** window to change your password.

> **NOTE:** *Your username and password must each be no longer than 16 characters. The username is not case-sensitive, but the password is case-sensitive. (Case-sensitive means that **B** is not the same as **b**.)*

If you are a superuser, you will have the options shown in Fig 13-10.

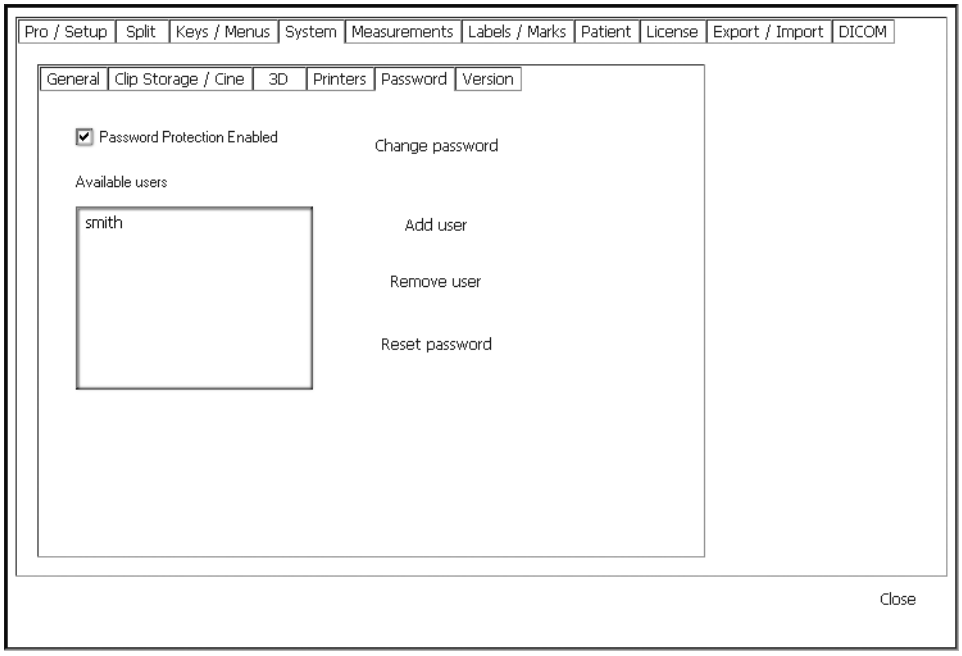


Figure 13-10. The Password Setup window for the superuser.

If password protection is disabled, then only the checkbox “Password Protection Enabled” (without a check) will be displayed. Only a superuser can enable or disable password protection.

Figure 13-11. The Password Setup window when password protection is disabled.

Measurements

You can customize the measurement setup so that each Pro Package contains exactly the measurements you want to use.

Defining measurements

You can import and export measurements and define new measurements that you can then use to measure features of ultrasound images. To define measurements, you use the **Measurement Definition Setup** window (page 179).

Organizing measurements

You can also arrange the measurements in groups and change the order in which they appear on the screen. For this you use the **Measurement Group Setup** window (page 184).

In the **Miscellaneous Measurement Setup** window (page 188), you can set various measurement parameters and change the way in which measurements are displayed.

User-Defined Measurements

You can define several types of measurements. Table 13-2 contains information about each type. The term “D-mode” means “Doppler mode”.

Type of User-Defined Measurement	Measurement Based On This	About the Calculation	Results
B-Mode Measurement	1 or no B-mode measuring tool	Formula can use results of other measurements	1
D-Mode Measurement	1 or no Doppler mode measuring tool	Formula can use results of other measurements	1
Gestational Age	1 B-mode measuring tool	GA and EDC calculated from factory-default or user-defined curve.	<type> GA EDC
Fetal Weight	1 or more results of other measurements	User-defined formula	FW
M-Mode Measurement	1 or no M-mode measuring tool	Formula can use results of other measurements	1

Table 13-2. Types of user-defined measurements and their properties.

To open the Measurement Definition Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Measurements** tab and then the other **Measurements** tab.

   The **Measurement Definition Setup** window opens, displaying a list of all user-defined measurements.

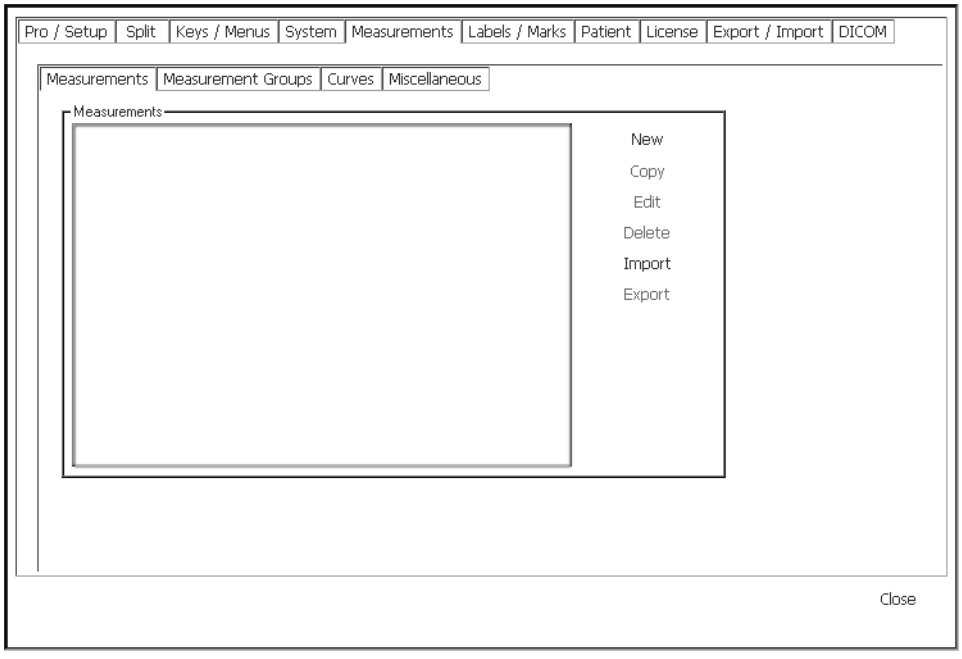


Figure 13-12. The Measurement Definition Setup window.

You have the following options in the **Measurement Definition Setup** window.

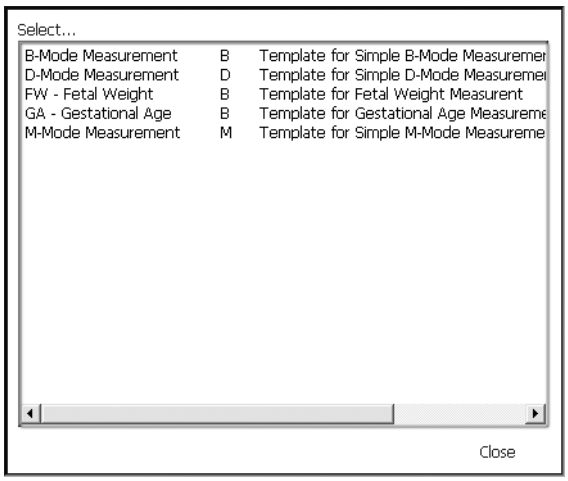
Option	What it does
New	Opens the Measurement Definition Wizard so you can define a new measurement.
Copy	Creates a new user-defined measurement as a copy of the currently selected measurement. You must enter a new name and description. You can then edit it to create a new user-defined measurement.
Edit	Opens the Measurement Definition Wizard so you can edit the selected user-defined measurement.
Delete	Deletes the selected user-defined measurement. You are asked to confirm the deletion.
Import	Imports a measurement from an external storage device. If the measurement depends on other measurements, you are prompted to import them, too.
Export	Exports a measurement to an external storage device. ***Note:*** *If the measurement depends on other measurements, they will not be exported automatically. You must do this manually by selecting user-defined ones for export. Factory-defined measurements do not need to be exported because they will exist on all scanners.*

Table 13-3. Options in the Measurement Definition window.

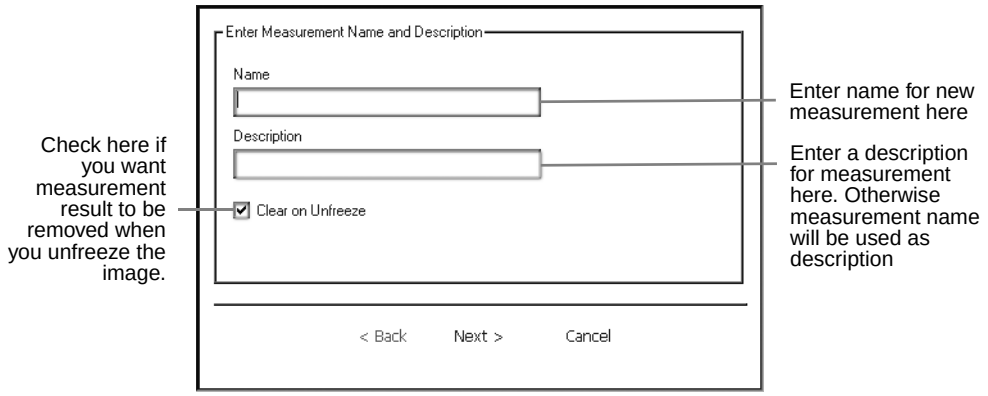
Using the Measurement Definition Wizard

To define a new measurement or edit an existing one:

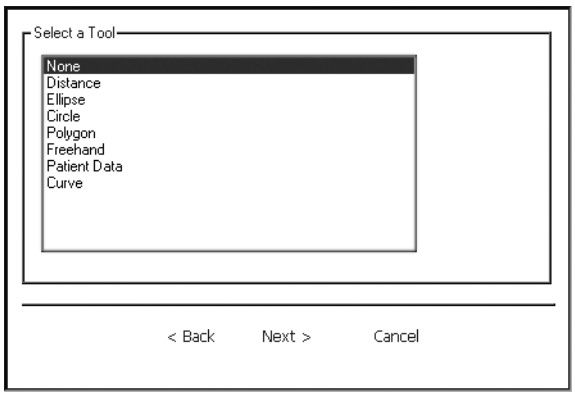
1 In the **Measurement Definition Setup** window, click **New** or select an existing measurement and click **Edit**.


Select...
B-Mode Measurement B Template for Simple B-Mode Measuremer
D-Mode Measurement D Template for Simple D-Mode Measuremer
FW - Fetal Weight B Template for Fetal Weight Measurent
GA - Gestational Age B Template for Gestational Age Measureme
M-Mode Measurement M Template for Simple M-Mode Measureme
Close

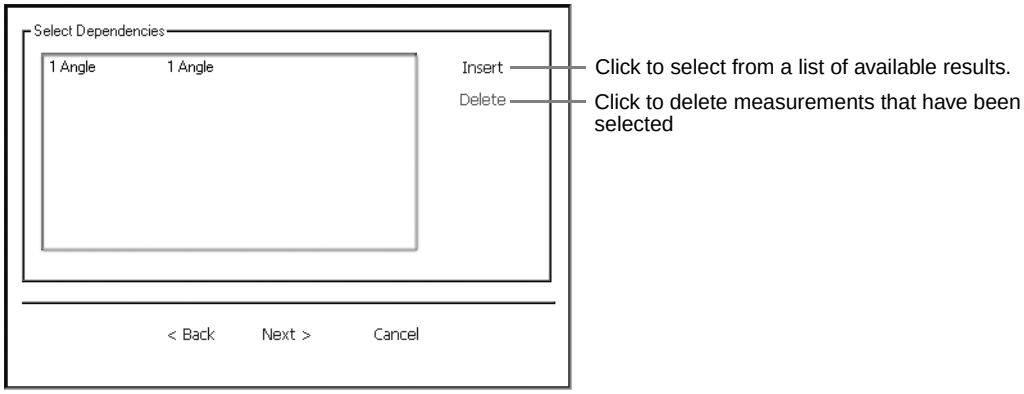
2 Select a template that the measurement will be based on. (This step does not appear if you are editing an existing measurement.)


Enter Measurement Name and Description
Name
Description
Clear on Unfreeze
< Back
Next >
Cancel
Check here if you want measurement result to be removed when you unfreeze the image.
Enter name for new measurement here
Enter a description for measurement here. Otherwise measurement name will be used as description

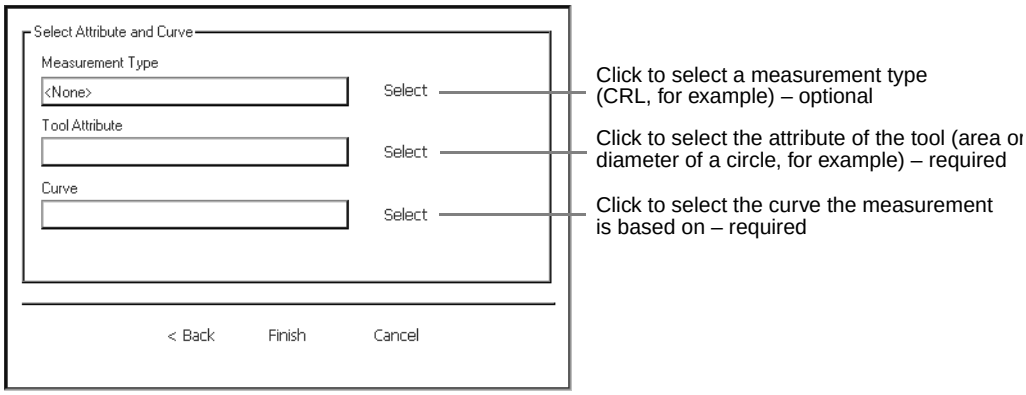
3 Enter a name and description for the new measurement. Decide whether you want the measurement result to be removed when you unfreeze the image. If you use measurements made on images from different scanning planes, you probably do *not* want it removed.



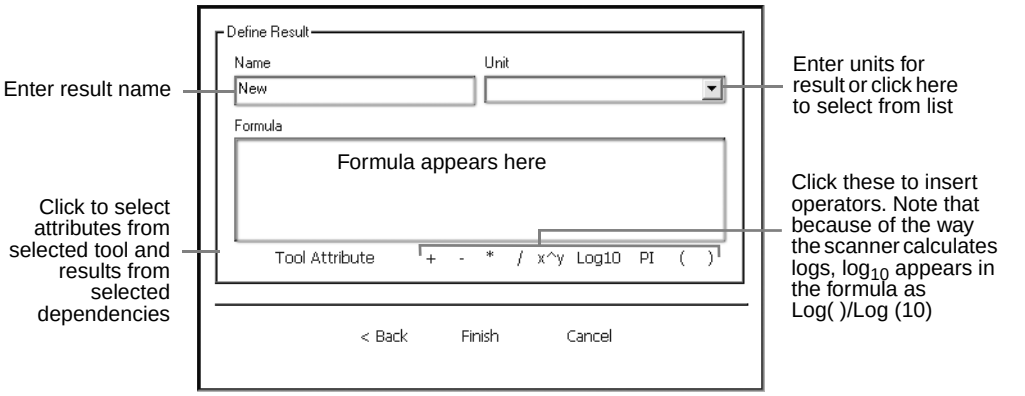
4 Select a measuring tool. (Fetal weight measurements skip this step.) The tools that are available depend on the type of measurement you are defining.



5 Select dependencies. (Gestational age measurements skip this step.) That is, select the results from other measurements that you want your measurement to use.


Select Attribute and Curve
Measurement Type
<None>
Select
Tool Attribute
Select
Curve
Select
< Back
Finish
Cancel
Click to select a measurement type (CRL, for example) – optional
Click to select the attribute of the tool (area or diameter of a circle, for example) – required
Click to select the curve the measurement is based on – required

6 For gestational age measurements only, select a measurement type (optional), tool attribute (required) and curve (required).


Define Result
Name
New
Unit
Formula
Formula appears here
Tool Attribute
+ - * / x^y Log10 PI ( )
< Back
Finish
Cancel
Enter result name
Enter units for result or click here to select from list
Click to select attributes from selected tool and results from selected dependencies
Click these to insert operators. Note that because of the way the scanner calculates logs, log10 appears in the formula as Log( )/Log (10)

7 Define the name and units of the result of the measurement. Then define the formula for the measurement. The formula must follow the syntax in Table 13-4. An example of a formula is

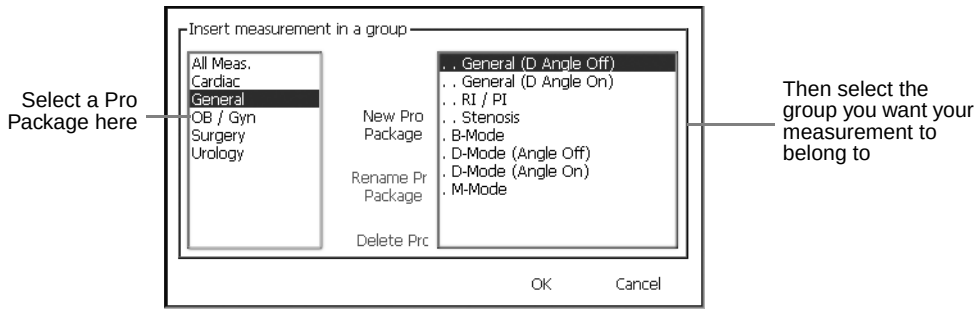
```
3.1419*([Distance.Distance_mm]/2)^2
```

(Gestational age measurements skip this step.)

Part of Formula	Syntax
Tool	[<tool name>.<attribute value>]
Dependency	[<dependency name>.<dependency result name>]
Argument list (ARG_LIST)	<tool name>.<attribute value> or <tool name>.<attribute value>,ARG_LIST or <tool name>.<dependency result name> or <tool name>.<dependency result name>,ARG_LIST

Table 13-4. Formula syntax for measurements.

8 Click **Finish**. (If the formula contains errors, you will not be able to continue until you correct them.)



9 If you are defining a new measurement, insert it into a measurement group for the selected Pro Package by selecting the Pro Package and then the measurement group.

You can also edit measurement groups in the **Measurement Group Setup** window. (See page 184.)

Measurement Group Setup

To open the Measurement Group Setup window:

1 Click **Setup** under **Image** on the right side of the screen to open the various setup windows.

2 Click the **Measurements** tab and then the **Measurement Groups** tab.

The **Measurement Group Setup** window opens with a list of Pro Packages on the left, a list of measurement groups in the middle, and a list of measurements on the right.

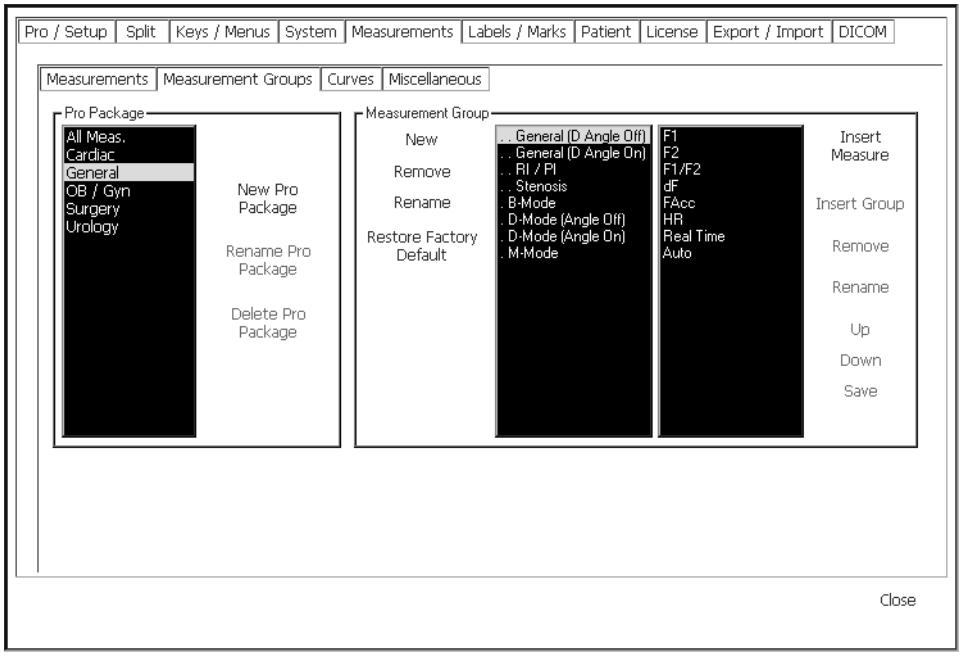


Figure 13-13. The Measurement Group Setup window.

When you click a Pro Package in the left-hand list, the measurement groups currently available in the Pro Package are displayed in the middle list. When you click one of the groups, the measurements currently in the group are displayed in the right-hand list. For each group, you can add new measurements, remove measurements, and move each one up and down in the list that will appear on the screen next to the scanned image. You can also add and name new measurement groups in this window.

Curves

You use the **Curve Setup** window to define a curve or to edit an existing user-defined one.

To open the Curve Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Measurements** tab and then the **Curve** tab.

   The **Curve Setup** window opens with a list of curves on the left, fields containing information about the curves in the middle, and a list of options on the right.

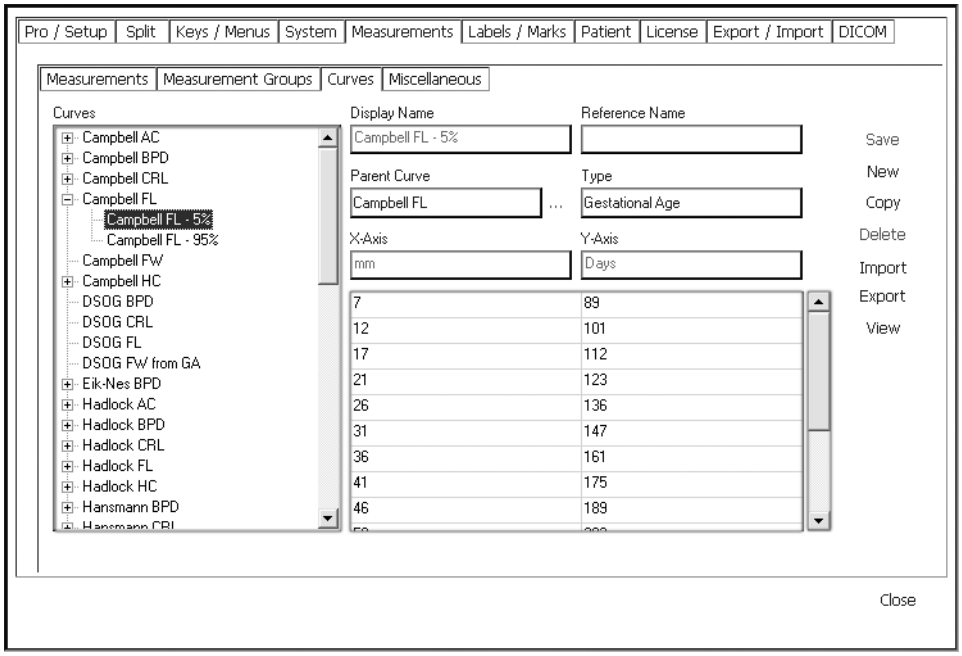


Figure 13-14. The Curve Setup window.

Curve list

The list contains all available curves, including all user-defined ones. The list is displayed in a the form of a "tree". If a curve appears with a + to the left of it, it has related (percentile) curves that will be displayed with it. Click on the + to expand the tree and see the related curves. The + becomes a - when the list is expanded. Click - to collapse the list again.

Child and parent curves

NOTE: *The percentile curves are called "child" curves. The curve that they are related to (and displayed with) is called the "parent" curve.*

Information fields

When the window opens, no curve is selected. The information fields are blank, and you can use them to create a new curve.

When a curve in the list is selected, the information fields contain information about the selected curve. If the selected curve is user-defined, you can edit the information in the fields.

The actual values of the curve are listed below the other information fields.

Information Field	Contents
Display Name	The name you give the curve. It will appear with this name on the scanner. You are warned if you try to give a curve a name that is not unique, but you can do it anyway.
Reference Name	The reference name is used to reference curves from measurement formulas. The reference name must be unique. That will be checked when you click **Save**.
Parent Curve	The parent curve that will be displayed with the curve you are defining. Click to select a parent curve from a list.
Curve Type	The type of curve: • Gestational Age • Fetal Weight From Gestational Age • None (some other type or not a specific type) Measurements based on a GA-curve will be available in the reports. The default FW-curve will also be available in the reports.
X-Axis	A label for the x-axis of the curve.
Y-Axis	A label for the y-axis of the curve.
Curve Values	The curve values are entered in the spreadsheet-like control at the bottom of the dialog. The left column is the x-axis and the right column the y-axis. You do not have to enter the values in a sorted order. The database will sort the x-values ascending. If a cell in the left column is empty, the y-value next to it is not used. There is no limit to the number of values you can enter to define a curve.

Table 13-5. Information fields in the Curve Setup window.

You have the following options in the **Curve Setup** window.

Option	What it does
Save	Saves a curve that you have edited or defined.
Copy	Creates a copy of the selected curve. Child curves are not included in the copy and must be copied separately. **Curve Type**, X-axis, Y-axis and points are copied. **Display Name**, **Reference Name** and **Parent Curve** are left blank so you can fill them in to create a new curve.
Delete	Deletes the selected curve. If the selected curve is a parent curve the children will be deleted as well. You are asked to confirm that you want to delete the curve.
Import	Imports a curve from an external storage device.
Export	Exports a curve to an external storage device. If the curve is a parent curve, the children will be exported as well.
View	Displays the currently selected curve. The curve dialog is opened and curve is displayed. This is very useful for verifying that curve points are positioned correctly.

Table 13-6. Options in the Curve Setup window.

Creating and Editing Curves

To create a new curve:

1. Open the **Curve Setup** window.
2. Click **New**.
3. Fill in the information fields and the values you want for the curve.
4. Click **Save**.

To edit an existing curve:

1. Open the **Curve Setup** window.
2. In the list on the left, click the curve you want to edit.
3. Edit the information fields (including the curve values) as you want to.
4. Click **Save**.

   NOTE: *You can only edit curves that you have defined. Curves that come with the scanner cannot be edited.*

Miscellaneous Measurement Setup

To open the Miscellaneous Measurement Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.

2 Click the **Measurements** tab and then the **Miscellaneous** tab.

The **Miscellaneous Measurement Setup** window opens.

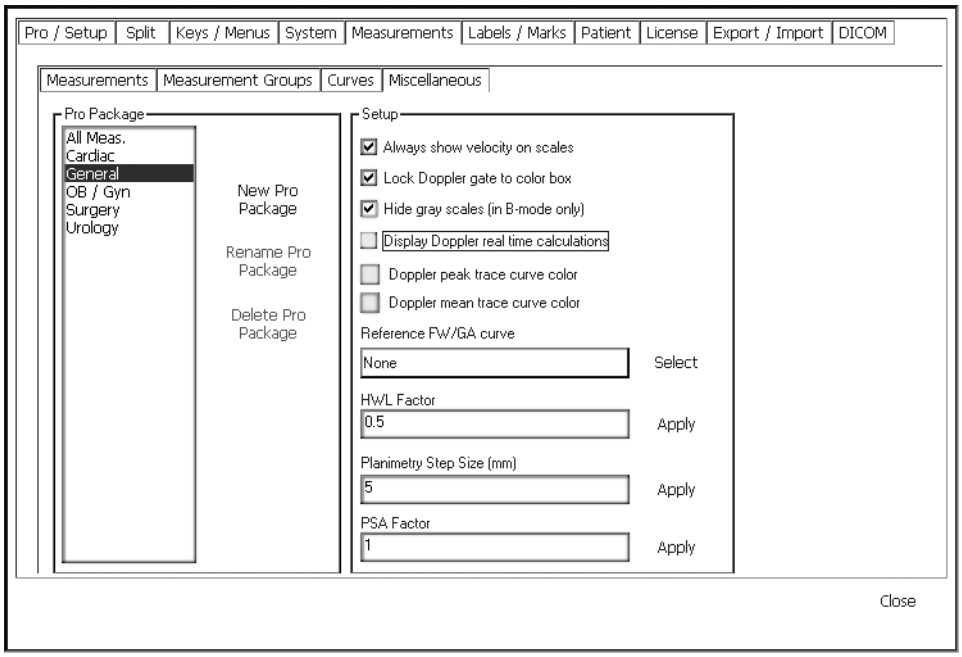


Figure 13-15. The Miscellaneous Measurement Setup window.

In this window you can specify:

- whether Doppler measurements are always shown in cm/s (velocity) or whether they are in kHz when the Doppler angle correction is turned off.
- whether the Doppler gate is locked to the color box – if you leave this box unchecked, the color box will not move when you drag the Doppler gate.
- whether gray scales are hidden in B-mode.
- whether Doppler real-time calculations are displayed all the time.
- the color for the Doppler peak or mean trace curve – to change the color, click the colored box and select the color you want (or create a custom color).
- the FW/GA curve that is used as a reference curve when you create a report.
- the HWL factor
- the planimetry step size
- the PSA factor

  NOTE: *Make sure to select the appropriate Pro Package on the left side of the window.*

Marks (Bodymarks, Labels, Puncture Guides)

You can customize the bodymark and label setup so that it is easy to use exactly the labels you want. You can also change the offset of a programmable Brachy matrix puncture guide.

For each Pro Package, you can:

- import new bodymarks/labels into any bodymark/label catalog
- copy bodymarks from one catalog to another
- delete bodymarks/labels from a catalog
- change the order in which bodymarks/labels in a catalog are displayed
- set a default position for bodymarks (and scanning plane indicator) and labels

Bodymark Setup

To make changes to the bodymark setup, you use the **Bodymark Setup** window.

To open the Bodymark Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Bodymarks/Labels** tab.
3. In the new window that appears, click the **Bodymark Catalogs** tab.

   The **Bodymark Setup** window opens.

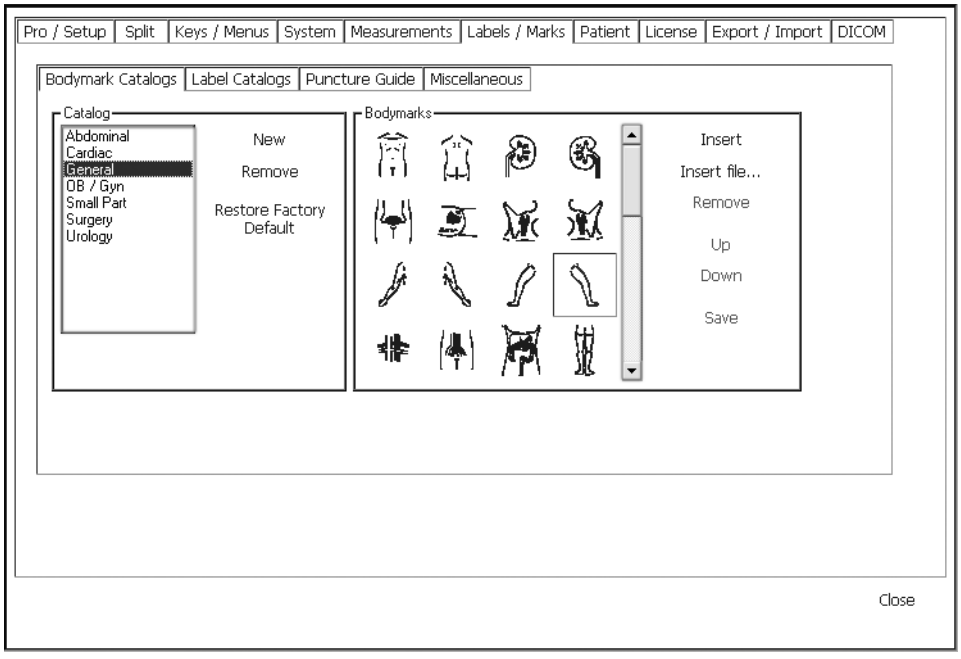


Figure 13-16. The Bodymark Setup window.

Adding or Removing a Bodymark Catalog

You can add a new catalog and then customize it to contain the bodymarks you want to use. You can remove any catalogs you do not want to use.

To add a bodymark catalog:

1. Click **New**.
2. Type a name for the new catalog in the box that appears.

   The new catalog (empty of bodymarks) appears on the right side of the window.

To remove a bodymark catalog:

1. Click the name of the catalog you want to delete.
2. Click **Remove**.

   You are asked to confirm that you want to delete the catalog. If you click **Yes**, the catalog is removed.

Factory default

To restore the factory default:

- Click **Restore Factory Default**.

  The catalog list and all bodymarks in each catalog are restored to the factory default settings.

Importing Bodymarks from a File to a Catalog

You can import bodymarks from a bitmap (.bmp) file to any of the bodymark catalogs. Images that you import must be:

- 100 x 100 pixels – larger images will be scaled
- black and white – color images will give unpredictable results

To import bodymarks to a catalog:

1. Open the **Bodymark Setup** window and select the catalog you want to import to.
2. Click **Insert file....**

   A file list appears, showing all .bmp files on all external storage devices.
3. Select (click) the files you want to import.

   The imported bodymarks appear at the beginning of the catalog.

Organizing Bodymarks in Catalogs

You can organize the bodymark catalogs as you like, adding and deleting bodymarks in a catalog, changing the order in which they appear in the catalog, deleting ones you don’t need and so on.

Copying bodymarks from another catalog

To copy a bodymark from one catalog to another:

1. In the **Bodymark Setup** window, click **Insert**.

The **Bodymark** window appears.

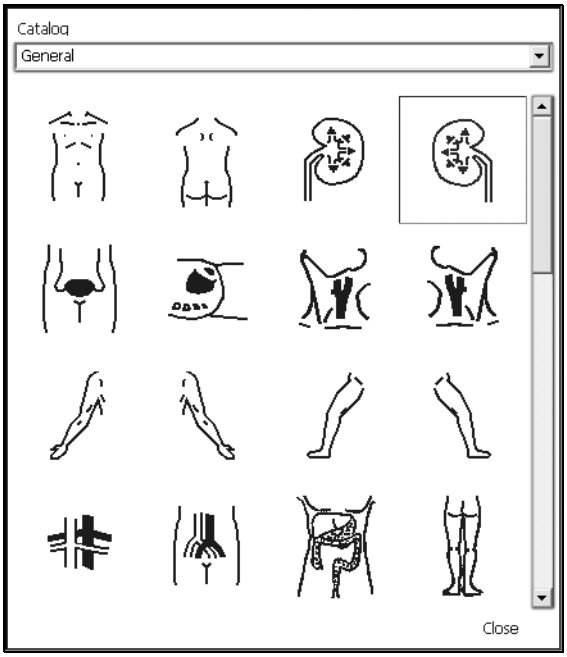


Figure 13-17. The Bodymark window with the General catalog displayed.

2 Click the catalog drop-down menu at the top of the window to select the catalog you want to copy a bodymark from.

That catalog is displayed in the **Bodymark** window.

3 Click the bodymark you want to copy.

The **Bodymark** window disappears, and the copied bodymark is inserted at the beginning of the catalog on the right side of the **Bodymark Setup** window.

Deleting a bodymark

To delete a bodymark from a catalog:

1 Click the bodymark (in the **Bodymark Setup** window).

2 Click **Remove**.

Changing the order

To move a bodymark up or down in the catalog:

1 Click the bodymark to select it.

2 Click **Up** or **Down**.

The bodymark moves up (or to the left) or down (or to the right) in the catalog.

Saving Changes

To save the changes you have made in the **Bodymark Catalog** window, click **Save**.

Label Setup

To make changes to the label setup, you use the **Label Setup** window.

To open the Label Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various Setup windows.
2. Click the **Bodymarks/Labels** tab, and then, in the window that appears, the **Label Catalogs** tab.

   The **Label Setup** window opens.

Figure 13-18. The Label Setup window.

Adding or Removing a Label Catalog

You can add a new catalog and then customize it to contain the labels you want to use. You can remove any catalogs you do not want to use.

To add a label catalog:

1. Click **New**.
2. Type a name for the new catalog in the box that appears.

   The new catalog (empty of labels) appears on the right side of the window.

   You can now add labels to the category. See “Importing Labels from a File to a Catalog” on page 193.

To remove a label catalog:

1. Click the name of the catalog you want to delete.
2. Click **Remove**.

   You are asked to confirm that you want to delete the catalog. If you click **Yes**, the catalog is removed.

Factory default

To restore the factory default:

- Click **Restore Factory Default**.

  The catalog list and all labels in each catalog are restored to the factory default settings.

Importing Labels from a File to a Catalog

You can import labels from a text (.txt) file to any of the label catalogs. One line in the file is treated as one label. Empty lines are ignored.

To import labels from a file to a catalog:

1. Open the **Label Catalog** window and select the catalog you want to import to.
2. Click **Insert file**....

   A file list appears, showing all .txt files on all external storage devices.
3. Select (click) the file you want to import.

   The imported labels appear at the end of the catalog.

Adding a Label to a Catalog or Removing One

You can organize the label catalogs as you like, adding and deleting labels, changing the order in which they appear in the catalog, deleting ones you don't need and so on.

To delete a label from a catalog:

1. In the **Label Setup** window, select the catalog.
2. Click the label in the list.
3. Click **Remove**.

Changing the order

To move a label up or down in the catalog:

1. Click the label to select it.
2. Click **Up** or **Down**.

   The label moves up or down in the catalog.

Saving Changes to a Catalog

To save the changes you have made to a label catalog in the **Label Setup** window, click **Save**.

Brachy Matrix Setup

Some transducers (such as Type 8658) support a programmed brachy matrix, that is, one that can be offset to the left or right and in or out.

To open the Brachy Matrix Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various Setup windows.

2 Click the **Labels/Marks** tab, and then, in the window that appears, the **Puncture Guide** tab.

The **Brachy Matrix Setup** window opens.

Figure 13-19. The Brachy Matrix Setup window.

To change the offset in either direction:

1 Select the offset you want from the drop-down menu.

2 Click **Save** to save your setting.

Miscellaneous Marks Setup

You can customize some aspects of how bodymarks and labels work for each Pro Package.You do this in the **Miscellaneous Marks Setup** window.

To open the Miscellaneous Marks Setup window:

1 Click **Setup** under **Image** on the right side of the screen to open the various Setup windows.

2 Click the **Labels/Marks** tab, and then, in the window that appears, the **Miscellaneous** tab.

The **Miscellaneous Marks Setup** window opens.

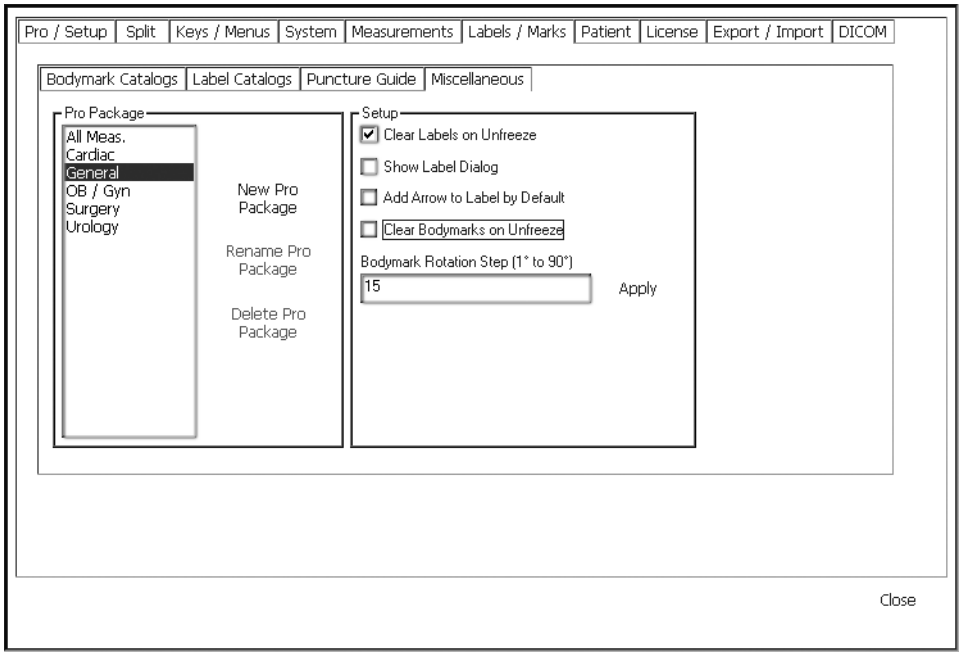


Figure 13-20. The Miscellaneous Marks Setup window.

In this window you can specify whether you want labels and bodymarks to be cleared when you begin scanning after the image has been frozen. You can also choose to have the label dialog displayed or not. You can specify whether each label automatically has an arrow attached to it.

Finally, you can change the step size per click that is used when you rotate the scanning plane indicator. Type a number of degrees in the field and click **Apply** or press **Enter**.

Patient Window Setup

You can change some of the fields in the **Patient** window so that you record the information you need about each patient. The **Patient** window can contain different fields for each Pro Package.

To make changes to the **Patient** window, you use the **Patient Setup** window.

To open the Patient Setup window:

1. Click **Setup** under **Image** on the right side of the screen to open the various setup windows.
2. Click the **Patient** tab.

   The **Patient Setup** window opens with a list of Pro Packages on the left and a list of the available fields on the right. The fields with a dark background are the ones that show up in the **Patient** window.

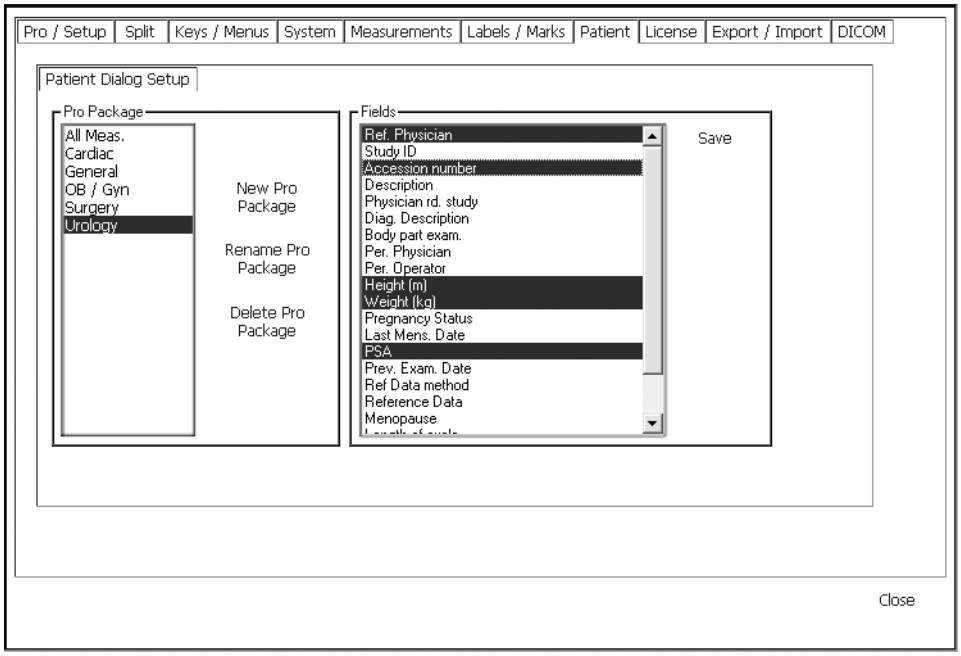


Figure 13-21. The Patient Setup window.

3 Click the fields you want (up to a maximum of 12), and then click **Save**.

Licenses

The following options require a license in order to use them:

- DICOM
- 3D
- Picture in Picture (PiP)

When you purchase one of these options, you will receive a 16-character license key. To activate the option, you will have to type the license key into the **License Manager** window.

To open the License Manager window:

1 Click **Setup** under **Image** on the right side of the screen to open the various setup windows.

2 Click the **License** tab.

The **License Manager** window opens.

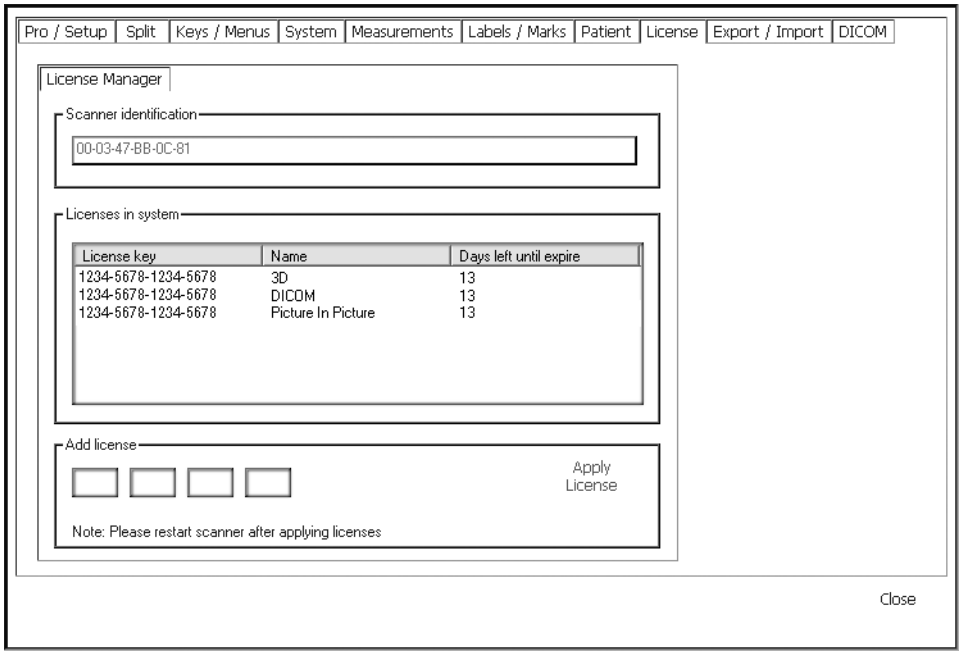


Figure 13-22. The License Manager window.

3 Type the license key in the fields in the **Add License** box.

4 Click **Apply License**.

The **Licenses in system** list is updated.

5 Close the **License Manager** window.

You must restart the scanner before you can use the option.

> **NOTE:** *A license key is valid for only one scanner and one option. You must have a different key for each option and for each scanner.*

Importing or Exporting Pro Packages and System Settings

You can export or import a Pro Package to or from an external storage device. When you do this, the bodymarks, labels, user-defined key assignments, Doppler/M-Mode screen layout, measurement groups, and patient window setup that are associated with the Pro Package are exported or imported. A fetal weight curve may also be included if appropriate.

You can also import or export system settings that go with the Pro Package. These include DICOM settings, video settings and format, language and hospital name.

To open the Export/Import window:

1 Click **Setup** under **Image** on the right side of the screen to open the various Setup windows.

2 Click the **Export/Import** tab.

The **Pro Packages** tab in the **Export/Import** window opens with a list of Pro Packages. Use this tab to import or export Pro Packages. Click the **System Settings** tab to import or export system settings.

Figure 13-23. The Export/Import window.

To export a Pro Package or system setting:

1. From the list on left, select the item you want to export.
2. Click **Export**.

   When you point to **Export**, a triangle appears to the right of it (see Fig 13-23). Click the triangle to choose whether you want to export to a CD or a flash memory device.

   NOTE: *If you export to a flash memory device, make sure that it is not set to be write-protected.*
3. Type in a file name when you are prompted.
4. Press **Enter**.

   NOTE: *See “Using CDs” on page 109 and “Using Flash Memory” on page 111.*

To import a Pro Package or system setting:

1. Insert a CD/DVD or flash memory device containing the Pro Packages or system settings you want to import.
2. Click **Import**.

   A list of files appears.
3. Click the ones you want to import.

In this window you can also create a new Pro Package (and then add labels and Diagnostic Setups to it, for example). You can also rename or delete a Pro Package by selecting the one you want to rename or delete and then clicking **Rename Pro Package** or **Delete Pro Package**.

DICOM Setup

Installing and setting up

DICOM is not installed on the Pro Focus as a default. You must purchase a DICOM license from B-K Medical before a qualified service technician can install DICOM on your scanner. The *2202 Service Manual* (BI2201) contains instructions for service personnel to use when setting up your DICOM system.

Changing setup

If DICOM is enabled on your scanner, various DICOM setup windows can be accessed by clicking the **DICOM** tab after you click **Setup** under **Image** on the right side of the screen.

Caution: Changing the DICOM setup can cause your system not to work properly. For example, you may be unable to print to a DICOM printer. All changes to the DICOM setup should be made by qualified service personnel only.

Chapter 14
Care of the Scanner

Cleaning

To ensure the best results when using B-K Medical equipment, it is important to maintain a strict regular cleaning routine.

Infection control

WARNING Users of this equipment have an obligation and responsibility to provide the highest possible degree of infection control to patients, co-workers and themselves. To avoid cross-contamination, follow all infection control policies for personnel and equipment that have been established for your office, department or hospital.

Caution: Keep all plugs and sockets absolutely dry at all times.

Scanner Unit and Keyboard Panel

Keyboard panel not watertight

Caution: The keyboard panel is **not** watertight. Be careful not to spill any liquids, gels or moist substances on the keyboard panel.

Figure 14-1. The keyboard panel with holders for transducers and scanning gel.

Clean the scanner, including the keyboard panel, after every examination:

1. Use a soft cloth moistened with a mild detergent or a disinfectant. Disinfectants that the scanner can withstand are listed in Appendix C, “Specifications”.
2. Wipe dry with a lint-free cloth.
3. You can remove the holders for transducers and scanning gel from the scanner to clean them. The trackball can also be removed for cleaning. See page 54 for instructions on using the trackball tool (QA0228) to loosen the trackball.

Although the scanner surface is resistant to many chemicals, strong chemicals may discolor it.

Palm Control Unit (PCU)

You must wear gloves during all stages of cleaning.

To clean the PCU:

1. Make sure that the PCU is at room temperature.
2. Remove the CIV-Flex™ sheath from the PCU.
3. Immediately rinse off any visible contamination (such as biological substances) with a detergent and tap water at a maximum temperature of 40° C (104° F), using a brush if necessary. Keep the bioburden[1] at a minimum.

Caution: Keep all plugs and sockets absolutely dry at all times.

Transducers and Puncture Attachments

Please refer to the *General Transducer Information* (BB0555) manual for instructions for cleaning transducers and puncture attachments.

Disinfection

For disinfecting ultrasound equipment, B-K Medical recommends the methods listed in Appendix C, “Specifications”, but follow local government rules and guidelines at all times.

Palm Control Unit (PCU)

Various methods can be used to disinfect the PCU. For some methods, the PCU plug must be covered as described below in “Immersion”. For some other methods, the plug must *not* be covered. It is important to read the precautions for a method before you use it.

Table 14-1 on page 204 contains an overview of the disinfection methods.

1. The bioburden of used instruments varies. Data are scarce, but it is suggested there is a low bioburden after cleaning surgical instruments (98% of instruments have less than 10^2 living organisms after cleaning) [1].

Immersion

After the PCU has been cleaned as described on page 202, it can be disinfected by immersion. The PCU itself is a sealed unit and can be totally immersed. When the PCU plug is covered with its special water-tight plug cover, you can immerse the entire PCU, including the plug. (See Fig 14-2.)

See *General Transducer Information* (BB0555) for more information about disinfection using immersion.

Protect plug before immersing

Caution: Screw the plug cover on tightly before you immerse the plug. If fluid comes into contact with the plug, the PCU may be destroyed.

Figure 14-2. The PCU plug with water-tight cover removed and screwed tightly on.

STERRAD®

After the PCU has been cleaned as described on page 202, it can be processed using the STERRAD® System.

WARNING Always follow the manufacturer's instructions for using the STERRAD® System.

Caution: The watertight PCU plug cover MUST NOT be screwed on while the PCU undergoes the STERRAD® process.

Caution: After each processing, you must check the PCU for surface pits and cracks.

STERIS SYSTEM 1®

After the PCU has been cleaned as described on page 202, it can be processed using STERIS SYSTEM 1®.

WARNING Always follow the manufacturer's instructions for using STERIS SYSTEM 1®.

Caution: The watertight PCU plug cover MUST be screwed on while the PCU undergoes the STERIS SYSTEM 1® process.

Ethylene Oxide Gas (ETO)

After the PCU has been cleaned as described on page 202, it can be processed using ethylene oxide gas.

WARNING When using ethylene oxide, always follow the manufacturer's directions for use and the instructions regarding personal protection.

Caution: The watertight PCU plug cover MUST NOT be screwed on while the PCU is processed with ethylene oxide.

Summary of Disinfection/Sterilization Methods

Disinfection Method	Watertight Plug Cover On/Off
Immersion	On
STERIS	On
STERRAD	Off
ETO	Off

Table 14-1. Methods of disinfection/sterilization for the PCU.

WARNING If there are any pits or cracks on the surface of the PCU, processing may not give a sterile product.

Transducers and Puncture Attachments

Please refer to the *General Transducer Information* (BB0555) manual for instructions for disinfecting transducers and puncture attachments.

3D Accessories

Endocavity Rotational Mover UA0550

After you use the Endocavity Rotational Mover (ECRM), wipe away any residual ultrasound gel with a clean, damp cloth.

You can use a suitable disinfectant to clean the ECRM further.

Do not immerse or autoclave

WARNING Do not immerse the ECRM in any liquid. Do not autoclave the ECRM.

Pullback Mover UA0552

Please refer to the pullback mover operations manual for instructions for disinfecting the Pullback Mover.

Storage

All B-K Medical ultrasound equipment should be stored in a cool, dry place and should never be exposed to temperatures below -25°C (-13°F) or above 70°C (140°F). Maximum storage humidity is 85% RH.

Maintenance

The scanner and transducers require regular maintenance.

Scanner Maintenance

To ensure scanner stability and performance, preventive maintenance should be carried out once a year. This *must* be done by a B-K Medical technician or a suitably qualified engineer.

Full detailed procedures for the preventive maintenance program can be found in the *2202 Service Manual* (BI2201), which can be obtained from B-K Medical. The program covers many areas:

Area	Action taken
Users' Comments and Corrections	Correct faults observed by the users.
Modifications to the System	In accordance with Service Information and Service Notes.
Mobility of the Scanner	In accordance with Service Information and Service Notes.
Checking Procedure	Verify the correct operation of the main functions of the scanner.
Peripherals	Check the function of the peripherals.
Electrical Safety Test	Verify that the system complies with EN/IEC 60601-1 [2] or UL 2601-1 [3] or CSA C22.2 No. 601.1–M90 [4].
Checking the ECG Module	Check the ECG Module to verify that the system complies with EN/IEC 60601-1 [2] or UL 2601-1 [3] or CSA C22.2 No. 601.1–M90 [4].

Table 14-2. Scanner preventive maintenance program.

All the equipment necessary for carrying out preventive maintenance can be obtained from B-K Medical.

Palm Control Unit Maintenance

The PCU should be checked by a B-K Medical service representative after every 150 times of disinfection by immersion.

Transducer Maintenance

See the *General Transducer Information* (BB0555) manual for information about transducer maintenance.

Alignment of the Brachy Matrix

B-K Medical recommends that you check the alignment of the matrix once a month (or more frequently if a misalignment is suspected).

NOTE: *The best accuracy that can be expected is 3mm deviation.*

To check the alignment of the matrix:

1. Fill a suitable tank with saline. The concentration of the saline depends on the room temperature. It should be 4% NaCl at 25°C and 5% NaCl at 20°C.
2. Assemble the matrix and, with a transducer mounted, connect the plug of the transducer to the scanner.
3. Immerse the transducer tip in the saline.
4. Start scanning to present an image on the monitor.
5. Superimpose the relevant puncture matrix template on the monitor.
6. Insert a needle through the matrix. Monitor the needle tip echo and measure the deviation from the matrix point shown on the monitor.
7. Decide whether the accuracy is acceptable.
8. If the accuracy is not acceptable, contact your local B-K Medical service center.

Disposing of the Scanner

When the scanner is scrapped at the end of its life, national rules for the various materials in each individual country must be followed.

The scanner contains many different materials, but none require any special treatment compared with what would normally be expected for materials used in electronic equipment.

Be aware, however, that the printed circuit boards are made of epoxy, the monitor's picture tube contains heavy metals and the scanner contains a small lithium battery.

For further information about the material composition of the scanner, contact your B-K Medical service representative.

In general, dispose of the scanner in a way that minimizes the effects on the environment.

References

[1] Nyström, B. Disinfection of surgical instruments. *Journal of Hospital Infection* 1981; 2:363-68.

[2] EN/IEC 60601-1:1990 +A1:1993+A2:1995+A13:1996 *Medical electrical equipment. Part 1: General requirements for safety.*

[3] UL 2601-1:2003 *Medical Electrical Equipment – Part 1. General Requirements for safety.*

[4] CSA C22.2 No. 601.1–M90:2001 *Medical Electrical Equipment – Part 1. General Requirements for safety.*

Part 5: Pro Packages

Chapter 15
General Pro Package

Introduction

This Pro Package contains:

- Diagnostic Setups
- labels and bodymarks
- a report
- measuring tools and calculations

used in basic ultrasound applications.

Before using this Pro Package, you should be familiar with the information in previous chapters, particularly Chapter 4, “Working with the Image”.

Abbreviations used in measurements and calculations are defined in the Glossary, starting on page 315.

The information in this chapter may not correspond to the Pro Package on your scanner because Pro Packages can be customized. (See Chapter 13, “Setting Up and Customizing Your System”.)

Transducers and Diagnostic Setups

This Pro Package supports the following B-K Medical transducer types and Diagnostic Setups. For each transducer, the factory default Diagnostic Setup for this Pro Package is indicated by bold type.

Transducer	Diagnostic Setup
8661	**5.0MHz Vaginal,** 6.5MHz Vaginal, 7.5MHz Vaginal
8662	**Neuro 1**, Neuro 2, Pediatric
8667	6.0MHz Prostate, **8.0MHz Prostate,** 10.0MHz Prostate,
8801	Abd-pen, Abd-persist, **Abd-res**, Bladder, Kidney, Sonovue®
8802	Abd-pen, Abd-persist, **Abd-res**, Bladder, Kidney
8803	Abd-pen, Abd-persist, **Abd-res**, Bladder, Kidney
8804	Carotid, Periph. Vein, **Small Part**
8805	Breast, Musculoskeletal, Periph. Artery, Periph. Vein, **Small Part**
8806	5.0MHz Vaginal, **6.5MHz Vaginal**, 7.5MHz Vaginal, 9.0MHz Vaginal
8809	**Finger**, Pancreas, Wrist
8811	Breast, Carotid, **Small Part,** Musculoskeletal, Periph. Artery, Periph. Vein
8812	Carotid, **Periph. Artery**, Periph. Vein
8815	**General**
8817	**Adb-res**

Table 15-1. Transducers and Diagnostic Setups for the General Pro Package.

Patient Setup

This Pro Package uses the standard **Patient** window for entering patient information. (See “Setting up a New Patient” on page 36.)

Labels and Bodymarks

This Pro Package contains a catalog of labels and bodymarks designed for General applications. See “Labelling Parts of the Image” on page 75 for information about using labels and “Using Bodymarks” on page 78 for information about using bodymarks.

General Reports

For information about reports, see “Reports” on page 114.

Measurements

For detailed instructions for using the measuring tools, see “Measurements and Calculations” starting on page 87.

To make a measurement:

1. Click its name under **Measurements** to the right of the image. (Some of the measurements are contained in submenus.)

   If there is a triangle following the name of the measurement, click the triangle to see the various options for making that measurement. Click the option you want. A small green light appears to the left of the currently selected measurement in the list.

   The appropriate measuring marker or tool appears on the image.

2. Position the marker where you want it (or draw with the drawing tool).

   If another marker is needed, it appears after you position the previous one.

3. Continue to position all needed markers.

After you have positioned all the markers, the result appears to the left of the image, at the bottom.

B-Mode Measurements

Measurement	Description	Measuring Tool
Distance		2 markers
Angle	Measure one or two angles	Angle
Ellipse		Ellipse
Circle		Circle
Polygon		Polygon
Freehand		Freehand drawing
Height	H used for HWL Volume	2 markers
Width	W used for HWL Volume	2 markers
Length	L used for HWL Volume	2 markers
VF Area	Volume Flow Area (VF Dist, VF Circle, VF Ellipse)	Distance, Circle, Ellipse

Table 15-2. B-mode measurements in the General Pro Package.

D-Mode (Doppler) Measurements

Measurement	Results	Measuring Tool
General (angle correction off)		
F1, F2	Frequency at position of marker 1 or 2	1 marker for each
F1/F2		2 markers (for F1 and F2)
dF	Frequency difference	2 markers (for F1 and F2)
dT	Time difference	2 markers
FACC	Frequency acceleration	2 markers (for F1 and F2)
Heart Rate (1-10)	Heart rate where the number in parentheses is the number of cycles between the markers.	2 markers
General (angle correction on)		
V1, V2	Velocity at position of marker 1 or 2	1 marker for each
V1/V2		2 markers (for V1 and V2)
dV	Velocity difference	2 markers (for V1 and V2)
dT	Time difference	2 markers
ACC	Acceleration (velocity)	2 markers (for V1 and V2)
TAM	Time Average Mean	2 markers or freehand curve
VF Area	Volume Flow Area (VF Dist, VF Circle, VF Ellipse)	Distance, Circle, Ellipse
VF	Volume Flow	Distance or area measuring tool for VF Area and drawing for TAM.
Heart Rate (1-10)	Heart rate where the number in parentheses is the number of cycles between the markers.	2 markers
RI/PI		
PS	Peak Systolic velocity	1 marker
ED	End Diastolic velocity	1 marker
RI	Resistance Index	(PS-ED)/PS (Measure PS, then ED)
PI	Pulsatility Index	2 markers or freehand curve

Measurement	Results	Measuring Tool
A/B	(Systolic velocity)/ (Diastolic velocity)	PS/ED (Measure PS, then ED)
B/A	(Diastolic velocity)/ (Systolic velocity)	ED/PS (Measure PS, then ED)
PS/ED	(Peak Systolic Velocity)/ (End Diastolic Velocity)	PS/ED (Measure PS, then ED)
Stenosis		
ST Dist 1	Transverse diameter of the vessel lumen before the stenosis.	Distance
ST Dist 2	Transverse diameter of the lumen at the stenotic part of the vessel.When you measure this after measuring ST Dist 1, % stenosis is calculated (formula on page 259).	Distance
ST Area 1	Area of vessel lumen before the stenosis. Used to calculate % stenosis.	Ellipse or freehand.
ST Area 2	Area of residual lumen of vessel used to calculate stenosis. When you measure this after measuring ST Area 1, % stenosis is calculated (formula on page 259).	Ellipse or freehand

Table 15-3. Doppler mode measurements in the General Pro Package.

Doppler Spectra

Most vascular calculations involve making measurements on a Doppler (FFT) spectrum.

You can fit a curve to the spectrum either automatically or manually and then make measurements on the curve. Two curve types are generally used:

This type of curve	is a trace of...
Peak (Max)	maximum points of the spectrum (those farthest from the baseline)
Mean	mean points of the spectrum

Table 15-4. Two types of Doppler curves.

WARNING Drawings of Doppler curves, manual and automatic, are meant as tools for positioning cursors so that measurements based on the curves can be calculated automatically. The General Pro Package contains no facilities for checking whether the automatic measurements are reasonable. Curves drawn on very noisy spectra may lead to misplacement of measurement cursors. Make sure that measurement cursors are positioned so that the results are reasonable. If they are not, you must adjust the position of the cursors manually.

Fig 15-1 depicts a Doppler spectrum with two cycles. A cycle starts at the *start systole* (when the heart starts to contract) and ends at the *end diastole* (when the heart is resting and filled with blood). The correct placement of vascular calculation markers is indicated in the figure.

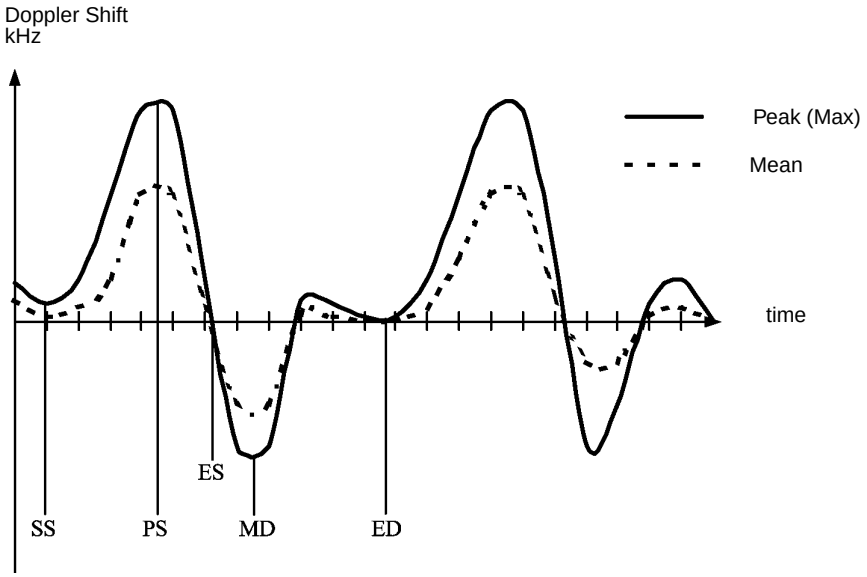


Figure 15-1. Doppler spectrum. Abbreviations explained below.

SS	Start systole	**MD**	Minimum diastole
PS	Peak systole	**ED**	End diastole
ES	End systole		

Frequency or velocity

The calculations and the way in which they are presented on the screen depend on whether the Doppler angle is active or not.

Doppler Angle Active? (Yes/No)	Velocity or Frequency
No	Frequency measured at intersection of marker line and Doppler curve.
Yes	Velocity measured, and frequency parameters replaced by corresponding velocity parameters, (dF by dV, FACC by ACC, F1 and F2 by V1 and V2.)

When the Doppler angle is turned off or altered, the results are recalculated.

Stenosis

The stenosis measurement uses the area of the vessel before or after the stenosis and the area of the vessel at the stenosis (residual lumen) to calculate the degree (%) of stenosis. You can base the stenosis calculation on the distance across the vessel or the area of the vessel lumen.

Stenosis Based on Distance

1 Click **ST Dist 1**.

Measure the total lumen of the vessel.

2 Click **ST Dist 2**.

Measure the residual lumen of the vessel.

The **ST Dist** value is updated continuously on the screen if you move one of the markers you reposition the markers.

Stenosis Based on Ellipses or Freehand Drawings

When you use areas to calculate stenosis, make one area measurement to measure each of the following:

- total lumen of the vessel
- residual lumen of the vessel

The result on the screen is continuously updated while you position the second ellipse or drawing.

VF (Volume Flow)

VF (Volume flow) is calculated by multiplying the time average mean velocity (TAM) by a defined cross-section of a vascular structure. The cross-section is measured on a B-mode image; the TAM is measured on a Doppler spectrum. These do not have to be measured on the same scan.

You can calculate VF based on cross-section measures using a distance (VF Dist), an ellipse (VF Ell) or a circle (VF Circ).

Doppler angle on

VF can only be measured with the Doppler angle on.

TAM (Time Average Mean)

The time average mean is the average value of measured frequencies over the time.

You can measure TAM in different ways:

- Automatic – the Doppler curve is drawn automatically and you position markers on it.
- Manual – you draw the Doppler curve manually.

Doppler angle on

TAM can only be measured with the Doppler angle on.

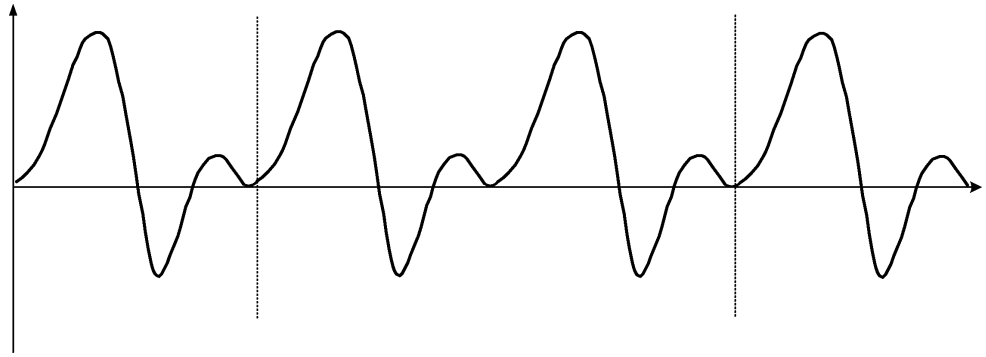


Figure 15-2. Measuring TAM on the Doppler spectrum.

To measure TAM on an automatically drawn curve:

1. Click **Auto**, then make sure that **TAM** is selected.
2. Position 2 line markers to specify the time interval over which the frequency values are averaged. (See Fig 15-2.)

   The TAM value is displayed to the left of the image.

You can also draw a Doppler curve manually on the spectrum and use it to measure TAM.

> **NOTE:** *Make sure that the trace appears to be a good fit to the spectrum so that the basis for the automatic calculation is correct.*

To measure TAM manually:

1. Click **TAM**.
2. Draw a curve that outlines the spectrum, starting and ending at the same part of the cycle.

RI and PI (Resistance Index and Pulsatility Index)

The resistance index (Pourcelot index) is based on the peak systolic velocity (V_{max}) and the end-diastolic minimum velocity ED (V_{ed}) in a supply vessel. RI indicates of the level of impedance to blood flow and a high RI suggests increased peripheral vascular resistance.

The pulsatility index represents the hemodynamic conditions in a vessel. It is based on the peak systolic velocity (V_{max}), the maximum velocity at minimum diastole ($V_{min\text{-}diast}$), and the average (V_{mean}) of the peak (max) flow velocity curve. PI describes the elasticity of the vessel combined with the level of peripheral resistance.

The A/B ratio (Stuart index) is calculated as the ratio between PS (V_{ps}) and ED (V_{ed}).

The advantage of using indices rather than absolute velocities is that the indices are independent of the insonation angle.

Index	Formula
A/B ratio	PS/ED
Resistance index	(PS-ED)/PS
Pulsatility index	(PS-MD)/Mean

Table 15-5. Formulas for the main Doppler indices.

The correct placement of markers for measuring RI and PI is indicated in Fig 15-1. “Mean” in the Pulsatility index formula is the averaged max flow velocity.

RI (Resistance Index)

To calculate RI and the A/B and B/A ratios, you place one marker to measure Peak Systolic Frequency (PS) and one to measure End Diastolic Frequency (ED).

To measure RI:

1. Click **RI**.
2. Position the first marker to measure PS.

   The PS measurement is displayed to the left of the image.
3. Position the second marker to measure ED.

   The ED measurement is displayed to the left of the image.

   The calculated RI value is displayed to the left of the image.

PI (Pulsatility Index)

You can measure PI in different ways:

- Automatic – the Doppler curve is drawn automatically and you position markers on it.
- Manual – you draw the Doppler curve manually (freehand).
- Real-time – the system calculates and displays PI automatically in real time. (See “Real-Time Measurements” below.)

Automatic

To measure PI automatically:

1. Click **Auto**, then make sure that **PI** is selected.
2. Position one marker at the *start systolic* (SS) frequency.
3. Position the second marker at the *end diastolic* (ED) frequency.

   The PI measurement is displayed to the left of the image.

If more than one cycle is included between the time cursors, the calculated PI is an average over the cycles.

> **NOTE:** *Make sure that the trace appears to be a good fit to the spectrum so that the basis for the automatic calculation is correct.*

Manual

To measure PI manually:

1. Click **PI**.
2. Position the marker on the *start systolic* (SS) frequency and click.
3. Draw a curve that traces a line along the whole maximum spectrum through the *peak systolic* (PS) frequency, the *minimum diastolic* (MD) and onto the *end diastolic* (ED) frequency.
4. Click.

   The PI measurement is displayed to the left of the image.

If the traced curve covers more than one cycle, the PI is calculated as the average of each cycle.

Real-Time Measurements

The following measurements can be made and displayed in real time so that they are continually updated while the image is scanning:

- PS
- ED
- MD
- PI
- RI
- HR

Real Time appears in two places on the right side of the screen. The upper one is used to turn real-time measurements on and off. The lower one is used to select the real-time measurements you want.

To turn real-time measurements on and off:

- Click **Real Time** under **Angle** on the right side of the screen**.**

  The real-time measurements are displayed to the left of the image when the function is turned on.

On the **Miscellaneous** tab of the **Measurement Setup** window, you can set the system so that real-time measurements are always displayed. See page 188.

> **NOTE:** *It is possible to collapse the section on the left that contains measurement results. If real-time measurements are not displayed, check to see whether the* **Measurement** *section is collapsed.*

To select which real-time measurements are displayed:

1. Freeze the image.
2. Click the small arrow to the right of **Real Time** under **Measurements**, and make sure that the ones you want are selected.
3. Unfreeze the image.

   NOTE: *If you freeze the image when real-time measurements are selected, the real-time results are also frozen.*

   NOTE: *When real-time measurements are turned on, automatic curve tracing is also turned on. Make sure that the trace appears to be a good fit to the spectrum so that the basis for the real-time calculation is correct.*

Noise Limit

You can reduce the noise (high frequency disturbances) in the data to improve the accuracy of automatically traced curves.

To reduce the noise:

- Click **Noise Limit** above **Angle** on the right of the screen and drag the slider.

Low noise limits cut out more noise; high limits cut out less.

Carotid Velocities

LICA, RICA, LCCA, RCCA, LECA, RECA, V1 and V2 are carotid velocities that are used to calculate the extent of stenosis in the carotid vessels.

The displayed velocity ratios are constantly updated as you change the measurement of either of the velocities in the ratio.

Doppler measurements that can be used to accurately assess flow-limiting stenosis are:

- Peak systolic velocity – determined at the point of maximum stenosis. The peak velocity is measured at the peak systolic point of the cardiac cycle.
- End diastolic velocity – determined at the point of maximum stenosis. The end diastolic velocity is measured at the end point of the cardiac cycle.

Calculations

Calculation Formulas

The system uses the following formulas to calculate various values.

For a definition of variables used in the formulas, see Table 15-7.

Value	Formula
Frequency Difference	$dF = F(t_2) - F(t_1)$
Velocity Difference	$dV = V(t_2) - V(t_1)$
Frequency Acceleration (FAcc)	$F_{acc} = \frac{F_{max}(t_2) - F_{max}(t_1)}{t_2 - t_1}$
Acceleration (Acc)	$Acc = \frac{V_{max}(t_2) - V_{max}(t_1)}{t_2 - t_1}$
Resistance Index/Pourcelot Ratio (RI)	$RI = \frac{F_{max}(t_{PS}) - F_{max}(t_{ED})}{F_{max}(t_{PS})}$
TAM (Time Average Mean)	$TAM = \frac{dt \cdot \sum_{t=t_1}^{t_2} V_{mean}(t)}{t_2 - t_1}$
A/B Ratio (Stuart Index)	$\frac{A}{B} = \frac{F_{max}(t_{PS})}{F_{max}(t_{ED})}$
Pulsatility Index (PI)	$PI = \frac{(t_{ED} - t_{SS}) \cdot (F_{max}(t_{PS}) - F_{max}(t_{MD}))}{dt \cdot \sum_{t=t_{SS}}^{t_{ED}} F_{max}(t)}$
Heart Rate (HR) per minute	$HR = \frac{\text{Number of Cycles} \times 60}{t_{ED} - t_{SS}}$
Stenosis (Distance)	$Stenosis(dist) = \frac{(D_1 - D_2)}{D_1} \times 100$
Stenosis (Area)	$Stenosis(area) = \frac{(A_1 - A_2)}{A_1} \times 100$
Volume Flow	$VF = TAM \cdot A$

Table 15-6. Vascular calculation formulas.

Variable	Definition
F_{max}	maximum frequency at a particular time
t_{SS}	time of start of the systole
t_{PS}	time of peak systole
t_{MD}	time of minimum diastole
t_{ED}	time of end diastole
t_1, t_2	2 points in time
t_2 - t_1	time difference between 2 measured points
dt	time between spectral lines
A	area of the vessel
A_1, D_1	transverse area (diameter) of the vessel lumen before the stenosis
A_2, D_2	transverse area (diameter) of the stenotic part of the vessel
n	number of measurements
$V_n(t)$	maximum velocity (in m/s) at time t
$\frac{t_{ED} - t_{SS}}{dt}$	number of spectral lines from the start of systole to the end of diastole

Table 15-7. Variables in vascular calculation formulas.

Calculation Accuracy

Factors Affecting Accuracy

The accuracy of the calculation is influenced by:

- Accuracy of the measured input parameter. This is shown in the *General Transducer Information* (BB0555).
- Accuracy of the empirically determined equations
- Rounding errors
- Selected noise reduction
- Accuracies of the curve definition
- Accuracy of the Doppler spectrum.

Accuracy in Vascular Calculations

Input parameter

The accuracy of the Doppler frequency is 5 % of the maximum blood flow velocity ($\theta = 55°$), which is tabulated in the *General Transducer Information* (BB0555) for each transducer capable of Doppler imaging.

The accuracy of time measurement is related to the digital resolution of the screen and is 0.2 % of the full time scale of the image field.

Accuracy of equations

The accuracy of the Doppler equations is calculated using the accuracy for the Doppler frequency and the time resolution.

Rounding errors

The finite resolution on the floating point numbers introduces an error into the calculations. The amount of this error is, however, insignificant compared to that introduced by the other factors listed above. Therefore, it is not taken into consideration.

Noise reduction

Selecting too high a noise reduction level introduces an unnecessary error: part of the spectrum itself is removed along with the noise. The amount of this error depends on the shape of the spectrum.

Curve definition and Doppler spectrum

The generation of automatic curves includes a “smoothing” which contributes to the accuracy of the curve.The amount depends on the shape of the spectrum, but it is typically less than 5%. To keep the amount low, it is essential to display only a few heart-rate cycles.

Here are some examples to guide you in evaluating the total expected accuracy of the calculations. In the examples, A = accuracy.

Accuracy of FACC and ACC Calculations

$A(F_{max}) = A(F_{min}) = 5\%$

$A(time) = 0.2\%$ of the full time range

Assuming $F_{max}(t_{PS}) \gg F_{max}(t_{SS})$ then

$$A(F_{acc}) = A(F_{max}) + \frac{0.002 \times T}{(t_{PS} - t_{SS})}$$

Example: $T = 4 \times (t_{PS} - t_{SS}) \Rightarrow A(F_{acc}) = 6\%$

Accuracy of Resistance Index/Pourcelot Ratio (RI)

$$A(RI) = \frac{(RI_{max} - RI_{min})}{RI} \quad \text{where}$$

$$RI_{max} = \frac{(1.025 \times F_{max}(t_{PS}) - 0.975 \times F_{max}(t_{ED}))}{1.025 \times F_{max}(t_{PS})} \quad \text{and}$$

$$RI_{min} = \frac{(0.975 \times F_{max}(t_{PS}) - 1.025 \times F_{max}(t_{ED}))}{0.975 \times F_{max}(t_{PS})}$$

Example: $F_{max}(t_{PS}) = 10 \times F_{max}(t_{ED}) \Rightarrow A(RI) = 1\%$ and

$F_{max}(t_{PS}) = 2 \times F_{max}(t_{ED}) \Rightarrow A(RI) = 10\%$

Accuracy of Pulsatility Index (PI)

$$A(PI) = A(F_{max}(t_{PS}) - F_{max}(t_{MD})) + A\left(\sum_{t = t_{SS}}^{t_{ED}} F_{max}(t)\right)$$

Assuming $F_{max}(t_{PS}) \gg F_{max}(t_{MD})$

Provides $A(F_{max}(t_{PS}) - F_{max}(t_{MD})) = A(F_{max}) = 5\% \Rightarrow$

$$A(PI) = A(F_{max}) + A\left(\sum_{t = t_{SS}}^{t_{ED}} F_{max}(t)\right) = 10\%$$

Accuracy of A/B Ratio (Stuart Index)

$A(A/B) = A(B/A) = 2 \times A(F_{max}) = 10\%$

Accuracy of Heart Rate (HR)

$A(HR) = A(time)$

Chapter 16
Urology Pro Package

Introduction

This Pro Package contains:

- Diagnostic Setups
- labels and bodymarks
- a report
- measuring tools and calculations

used in urology ultrasound applications.

For a list of the calculation formulas that are used, see page 235.

Before using this Pro Package, you should be familiar with the information in previous chapters, particularly Chapter 4, “Working with the Image”. For more details about placing measurement markers for Doppler measurements, see “Doppler Spectra”, starting on page 252.

Abbreviations used in measurements and calculations are defined in the Glossary, starting on page 315.

The information in this chapter may not correspond to the Pro Package on your scanner because Pro Packages can be customized. (See Chapter 13, “Setting Up and Customizing Your System”.)

Transducers and Diagnostic Setups

This Pro Package supports the following B-K Medical transducer types and Diagnostic Setups. For each transducer, the factory default Diagnostic Setup for this Pro Package is indicated by bold type.

Transducer	Diagnostic Setups
8551	10.0 MHz Prostate, 8.6 MHz Prostate, **7.5 MHz Prostate**, 6.0 MHz Prostate,
8658	7.5 MHz Prostate, **6.5 MHz Prostate**, 5.0 MHz Prostate,
8667	10.0 MHz Prostate, **8.0 MHz Prostate,** 6.0 MHz Prostate
8801	Bladder, **Kidney**
8802	Bladder, **Kidney**
8803	Bladder, **Kidney**
8804	**Testis**
8805	**Testis**
8808	10.0 MHz Prostate, **8.0 MHz Prostate,** 6.0 MHz Prostate, Split
8811	**Testis**

Table 16-1. Transducers and Diagnostic Setups for the Urology Pro Package.

Patient Setup

The **Patient** window for this Pro Package contains some special fields. (See “Setting up a New Patient” on page 36 for information about using the **Patient** window.)

PSA Parameters

You can enter the following PSA parameters in the **Patient** window:

Parameter	Range allowed
PSA	0 – 1000
PSA factor	0.00 – 5.00 (default value 1.00)

Table 16-2. PSA parameters.

Labels and Bodymarks

This Pro Package contains a catalog of labels and bodymarks designed for Urology applications. Labels and bodymarks from other catalogs are also available when using the Urology Pro Package. See “Labelling Parts of the Image” on page 75 for information about using labels and “Using Bodymarks” on page 78 for information about using bodymarks.

Reports

For information about Urology reports, see “Reports” on page 114.

Measurements

For detailed instructions for using the measuring tools, see “Measurements and Calculations” starting on page 87.

Some of the measurements are contained in the following submenus:

- Prostate Volume
- Kidney Volume
- Bladder Volume
- Adenoma Volume
- Testis Volume

The methods for calculating volume are slightly different, depending on the organ. For example, the empirical method can be used only with the bladder, and manual planimetry can be used only for the prostate and adenoma.

To make a measurement:

1. Click its name under **Measurements** to the right of the image. (Some of the measurements are contained in submenus.)

   If there is a triangle following the name of the measurement, click the triangle to see the various options for making that measurement. Click the option you want. A small green light appears to the left of the currently selected measurement in the list.

   The appropriate measuring marker or tool appears on the image.

2. Position the marker where you want it (or draw with the drawing tool).

   If another marker is needed, it appears after you position the previous one.

3. Continue to position all needed markers.

After you have positioned all the markers, the result appears to the left of the image, at the bottom.

B-Mode Measurements

Measurement	Description	Measuring Tool
Measurements		
Distance		Distance
Ellipse		Circle
Circle		Circle
Polygon		Polygon
Freehand		Freehand drawing
Height	H used for HWL Volume	Distance
Width	W used for HWL Volume	Distance
Length	L used for HWL Volume	Distance
VF Area	Volume Flow Area (VF Dist, VF Circle, VF Ellipse)	Distance, Circle, Ellipse
Prostate Volume		
Height	H (Height)	Distance
Width	W (Width)	Distance
Length	L (Length)	Distance
Ellipse	Pr-Vol (Prostate Volume)	Ellipse
Planimetry (Freehand)	Pr-Vol (Prostate Volume)	Freehand drawing
Planimetry (Ellipse)	Pr-Vol (Prostate Volume)	Ellipse
PSAD	Pr-Vol (Prostate Volume) PSAD	Volume measurement and type PSA value
Adenoma Volume		
Height	H (Height)	Distance
Width	W (Width)	Distance
Length	L (Length)	Distance
Ellipse	Ad-Vol (Adenoma Volume)	Ellipse
Planimetry (Freehand)	Ad-Vol (Adenoma Volume)	Freehand drawing
Planimetry (Ellipse)	Ad-Vol (Adenoma Volume)	Ellipse
Testis Volume		
Height	H (Height)	Distance

Measurement	Description	Measuring Tool
Width	W (Width)	Distance
Length	L (Length)	Distance
Ellipse	Ts-Vol (Testis Volume)	Ellipse
Kidney Volume		
Height	H (Height)	Distance
Width	W (Width)	Distance
Length	L (Length)	Distance
Ellipse	Kd-Vol (Kidney Volume)	Ellipse
Bladder Volume		
Height	H (Height)	Distance
Width	W (Width)	Distance
Length	L (Length)	Distance
Ellipse	Bl-Vol (Bladder Volume)	Ellipse
T-area (Freehand)	T-area (Transverse Area)	Freehand drawing
T-area (Ellipse)	T-area (Transverse Area)	Ellipse
L-area (Freehand)	L-area (Longitudinal Area)	Freehand drawing
L-area (Ellipse)	L-area (Longitudinal Area)	Ellipse
Empiric Volume	Bl-Vol (Bladder Volume)	(T-area and L-area)

Table 16-3. B-mode measurements in the Urology Pro Package.

D-mode (Doppler) Measurements

Measurement	Description	Measuring Tool
General (angle correction off)		
F1, F2	Frequency at position of marker 1 or 2	1 marker for each
F1/F2	Index	2 markers (for F1 and F2)
dF	Frequency difference	2 markers (for F1 and F2)
dT	Time difference	2 markers
General (angle correction on)		
V1, V2	Velocity at position of marker 1 or 2	1 marker for each
V1/V2	Index	2 markers (for V1 and V2)
dV	Velocity difference	2 markers (for V1 and V2)
dT	Time difference	2 markers
TAM	Time Average Mean	2 markers or freehand curve
VF Area	Volume Flow (VF Dist, VF Circle, VF Ellipse)	Distance, Circle, Ellipse
VF	Volume Flow	Distance or area measuring tool for VF Area and drawing for TAM.
RI/PI		
PS	Peak Systolic velocity	1 marker
ED	End Diastolic velocity	1 marker
RI	Resistance Index	(PS-ED)/PS (Measure PS, then ED)
PI	Pulsatility Index	2 markers or freehand curve

Table 16-4. Doppler measurements in the Urology Pro Package.

For more information about Doppler measurements, see Chapter 19, “Small Parts Pro”.

Calculating Volumes

Organ volumes can be calculated in several ways. For the formulas used for each of these calculations, and information about their accuracy, see “Urology Calculation Formulas” on page 235 and “Accuracy of Calculations” on page 237.

HWL

HWL is a method of calculating a volume using height, width and length measurements. To use this method to calculate the volume of a particular organ, use the Height, Width and Length measurements in the submenu for that organ volume.

To calculate an HWL volume:

1. Click **Height** and measure the height.

   The height appears under **Measurements** to the left of the image.
2. Click **Width** and measure the width.

   The width appears under **Measurements** to the left of the image.
3. Click **Length** and measure the length.

   The length appears under **Measurements** to the left of the image.

   The calculated volume appears under **Measurements** to the left of the image.

The height, width and length measurements must be made at right angles to each other. Therefore, you must use 2 scanned images for HWL calculations.

To make a measurement in the other part of a split screen:

- Press [▱▱].

or

- Move the cursor to the other screen and click.

Planimetry

For this method, you record a number of parallel B-mode images that cover the organ to be measured. On each image, you draw a curve that traces the outline of the structure. Thus you create a set of parallel section measurements of the structure.

These parallel sections (the outline measurements) are used to estimate the volume of the structure based on a number of equally spaced slices.

The accuracy of this method depends on starting the measurements in the correct place. Start at one end of the organ, where the scanned image shows an area of as close to 0 as possible. After each step, trace the outline of the structure on the scanned image. The system calculates the volume of the structure between the starting point and each new scan (see Fig 16-1). This is continued until the whole organ has been covered and a total volume obtained.

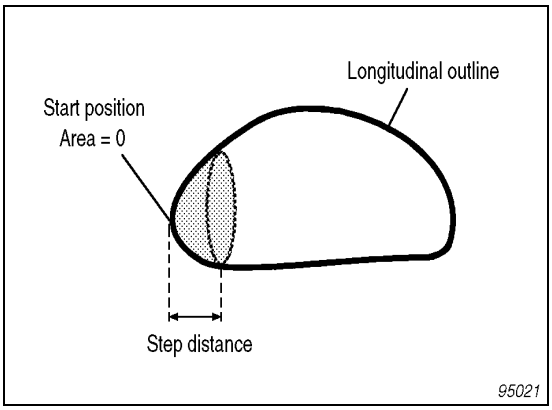


Figure 16-1. Longitudinal outline of organ showing the start position for planimetry

This method was analyzed in a study by Littrup et al [1] of 20 in vitro models and 100 patients. They found it to be an accurate technique for measuring prostate volume.

Different stepping units to control the spacing between the sections are available for use with different transducers.

To use this method to calculate the volume of a particular organ, use the Planimetry (Ellipse) or Planimetry (Freehand) measurements in the submenu for that organ volume. The planimetry method is only available for the prostate and adenoma.

To make a planimetry calculation:

1. Record a B-mode image at one end of the organ.
2. Advance the transducer one step.
3. Freeze the image.
4. Click **Planimetry (Ellipse)** or **Planimetry (Freehand)** and draw an ellipse or freehand drawing to outline the organ.
5. Repeat 2 through 4 until you have covered the entire organ.

   The Volume is displayed (updated after each measurement is drawn) at the bottom of the data area to the left of the image.

Reset — To reset the volume, press (long) [x••••x].

Empirical Method

The empirical method uses 2 orthogonal B-mode area outline measurements

- transverse (**T-area**)
- longitudinal (**L-area**)

to calculate volume. It is valid only for calculating bladder volume.

The calculation formula for this method is based on research by Rageth and Langer [2], in which they applied the empirical method in more than 200 cases studied. They found this approach to be a suitable method for routine clinical practice.

> **NOTE:** *When you outline the bladder for the empirical method, the outlines must represent the maximum areas of the bladder in the transverse plane (AT) and longitudinal plane (AL).*

To make an empirical volume calculation:

1. Click **Empirical** and draw an ellipse to outline the organ.
2. From the same transducer position, record another image at right angles to the first.
3. Click in the other part of the split screen and draw an ellipse to outline the organ.

   The Volume is displayed at the bottom of the data area to the left of the image.

Calculating PSAD

To calculate the PSAD (Prostate Specific Antigen Density), you calculate the volume of the prostate and type in a value for the PSA (Prostate Specific Antigen). The PSA is divided by the volume to give the PSAD. This method is discussed in an article by Benson et al [3] in which the method was used in a study of over 500 patients.

To calculate PSAD:

1. Click **PSAD** in the **Prostate Volume** measurement submenu.

   If you have not entered the PSA value in the **Patient** window, you are prompted to enter it. Type in the correct value.
2. Calculate the prostate volume using HWL. Ellipse or planimetry.

   The PSAD appears under **Measurements** to the left of the image.

If volume already calculated

You can also click **PSAD** after you have calculated the prostate volume. You will be prompted for the PSA value if you have not already entered it.

Urology Calculation Formulas

The following methods for estimating volume are available:

- Height × Width × Length x factor
- Planimetry
- Empirical method (valid only for the bladder).

There is also a method for calculating PSAD.

The formulas for the volume calculations in the Urology Pro Package are shown in Table 16-5. The variables in the formulas are defined in Table 16-6.

Volume Formulas

Value	Formula
HWL	Volume = H x W x L x Factor
Planimetry	$\text{Volume} = \sum_{i=2}^{N} \frac{1}{3}(PA(i) + PA(i-1) + \sqrt{PA(i) \cdot PA(i-1)}) \cdot \text{Stepsize}$
Empirical	$\text{Volume} = \exp(0.8304 + 0.5635 \cdot \ln(\min[AL, AT]) + 0.7211 \cdot \ln(\max[AL, AT]))$

Table 16-5. Urology calculation formulas.

Variable Definitions

Variable	Definition
HWL	
Prostate HWL Factor	0.523
Adenoma HWL Factor	0.523
Testis HWL Factor	0.523
Kidney HWL Factor	0.523
Bladder HWL Factor	0.570
The factor for kidney, testis, prostate, and adenoma implies that the organs have a true ellipsoid shape. For the bladder, the factor 0.57 is found to be more precise [4].	
Planimetry	
PA	Area of the recorded parallel section
Stepsize	Distance between parallel sections (default step size is 5 mm)
i	Step number

Table 16-6. Variables in urology calculation formulas.

PSA Density

Value	Formula
PSAD	$\text{Density} = \frac{\text{PSA}}{\text{Prostate Volume}} \cdot \text{PSA factor}$

Table 16-7. PSA Density formula.

The value of the PSA factor is 1.00.

Accuracy of Calculations

Factors Affecting Accuracy

The accuracy of each calculation is influenced by a number of factors:

- the accuracy of the measured input parameters (see the *General Transducer Information* (BB0555))
- the accuracy of the estimation methods
- the accuracy of the calculations

The error introduced in the calculations by the finite resolution of the floating point numbers is insignificant compared to that introduced by the other factors listed above. Hence, it is not taken into consideration.

The accuracy formulas in Table 16-8 are to be used as a guide to evaluating the total expected accuracy for the calculation methods. In the table, A = accuracy.

Calculation	Accuracy	Assumptions
HWL	A = A(H) + A(W) + A(L) = 3 x A(B-mode distance)	Formula used to calculate volume.
Planimetry	A = A(stepsize) + A(area)	Both area measurements made on same equipment The accuracy of clinical planimetry measurements on the prostate was found to be ±7% with 95% confidence interval [1]. **Note:** This method should only be used on organs which are approximately “cigar-shaped”.
Empirical	Less than 15% on average. See ref. 2.	This *only* applies when the method is used for measuring the bladder.
PSAD	A = A(area) = 4%	The formula used for calculating PSAD. The method is described in ref [4].

Table 16-8. Accuracy of urology calculation methods.

References

[1] Littrup PJ, Williams CR, Egglin TK, Kane RA. Determination of prostate volume with transrectal US for cancer screening. Part II. Accuracy of in vitro and in vivo techniques. *Radiology,* 179:49-53, 1991.

[2] Rageth JC and Langer K. Ultrasonic assessment of residual urine volume. *Urological Research*, 10:57-60, 1982.

[3] Benson MC, Whang IS, Olsson CA, McMahon DJ, Cooner WH. The use of prostate specific antigen density to enhance the predictive value of intermediate levels of serum prostate specific antigen. *The Journal of Urology*, Vol. 147, 817-821, March 1992.

[4] Brunn J, Ruf G. Sonografische Zystometrie. *Deutsche Med*, 105:1507-1503, 1980.

Chapter 17
Surgery Pro Package

Introduction

This Pro Package contains:

- Diagnostic Setups
- labels and bodymarks
- a report
- measuring tools and calculations

used in surgical ultrasound applications.

Before using this Pro Package, you should be familiar with the information in previous chapters, particularly Chapter 4, “Working with the Image”.

Abbreviations used in measurements and calculations are defined in the Glossary, starting on page 315.

The information in this chapter may not correspond to the Pro Package on your scanner because Pro Packages can be customized. (See Chapter 13, “Setting Up and Customizing Your System”.)

Palm Control Unit

If you are using this Pro Package with the optional Palm Control Unit, see “Using the PCU (Palm Control Unit)” on page 45 and “Palm Control Unit (PCU)” on page 70 for details of how to use the PCU.

Surgical Rack

If you using this Pro Package with the Rack Docking System™, see “Connecting to a Surgical Rack” on page 326 for details of how to connect your Pro Focus scanner to the surgical rack.

Transducers and Diagnostic Setups

This Pro Package supports the following B-K Medical transducer types and Diagnostic Setups. For each transducer, the factory default Diagnostic Setup for this Pro Package is indicated by bold type.

Transducer	Diagnostic Setup
1850	**Anal-1**, Anal-2, Rectal-1, Rectal-2
2050	**Anal-1**, Anal-2, Rectal-1, Rectal-2
8659	Liver, Bile Duct, IOUS Hi-Pen, **IOUS Hi-Res**, Pancreas
8662	**Neuro-1**, Neuro-2, Pediatric
8663	**Neuro-1**, Neuro-2,
8666	Liver, Bile Duct, IOUS Hi-Pen, **IOUS Hi-Res**, Pancreas
8809	**Pancreas**, Vascular
8811	Breast, Carotid, **Small Part**
8815	Liver, Bile Duct, IOUS Hi-Pen, **IOUS Hi-Res**, Pancreas

Table 17-1. Transducers and Diagnostic Setups for the Surgery Pro Package.

Patient Setup

This Pro Package uses the standard **Patient** window for entering patient information. (See “Setting up a New Patient” on page 36.)

Labels and Bodymarks

This Pro Package contains a catalog of labels and bodymarks designed for Surgical applications. Labels and bodymarks from other catalogs are also available when using the Surgery Pro Package. See “Labelling Parts of the Image” on page 75 for information about using labels and “Using Bodymarks” on page 78 for information about using bodymarks.

Reports

For information about Surgical reports, see “Reports” on page 114.

Measurements

For detailed instructions for using the measuring tools, see “Measurements and Calculations” starting on page 87.

To make a measurement:

1 Click its name under **Measurements** to the right of the image. (Some of the measurements are contained in submenus.)

If there is a triangle following the name of the measurement, click the triangle to see the various options for making that measurement. Click the option you want. A small green light appears to the left of the currently selected measurement in the list.

The appropriate measuring marker or tool appears on the image.

2 Position the marker where you want it (or draw with the drawing tool).

If another marker is needed, it appears after you position the previous one.

3 Continue to position all needed markers.

After you have positioned all the markers, the result appears to the left of the image, at the bottom.

B-Mode Measurements

Measurement	Description	Measuring Tool
Distance		2 markers
Ellipse		Ellipse
Freehand		Freehand drawing
Height	H (Height)	2 markers
Width	W (Width)	2 markers
Length	L (Length)	2 markers

Table 17-2. B-mode measurements in the Surgery Pro Package.

Doppler Mode Measurements

Measurement	Description	Measuring Tool
V1, V2	Velocity at position of marker 1 or 2	1 marker for each
RI	Resistance Index	(PS-ED)/PS (Measure PS, then ED)
PS	Peak Systolic velocity	1 marker
ED	End Diastolic velocity	1 marker

Table 17-3. Doppler mode measurements in the Surgery Pro Package.

Real-Time Measurements

Measurement	Description	Measuring Tool
PS	Peak Systolic velocity	
ED	End Diastolic velocity	
MD	Minimum Diastolic velocity	
PI	Pulsatility Index	
RI	Resistance Index	
HR	Heart Rate	Beats per minute
TAM	Time Average Mean	cm per second
TAMX	Time Average Maximum	cm per second

Table 17-4. Real-time measurements in the Surgery Pro Package.

Surgery Reports

For information about making reports in this Pro Package see “Reports” on page 114.

Labels and Bodymarks

For more information about using labels and body marks in this Pro Package see “Working with the Image” on page 73.

Chapter 18
OB/Gyn Pro Package

Introduction

This Pro Package contains:

- Diagnostic Setups
- labels and bodymarks
- a report
- measuring tools and calculations

used in obstetrical and gynecological ultrasound applications.

For a list of the measurements you can make, see page 245. The tables and formulas that the system uses for calculations are listed starting on page 252.

Before using this Pro Package, you should be familiar with the information in previous chapters, particularly Chapter 4, “Working with the Image”.

Abbreviations used in measurements and calculations are defined in the Glossary, starting on page 315.

The information in this chapter may not correspond to the Pro Package on your scanner because Pro Packages can be customized. (See Chapter 13, “Setting Up and Customizing Your System”.)

Transducers and Diagnostic Setups

This Pro Package supports the following B-K Medical transducer types and Diagnostic Setups. For each transducer, the factory default Diagnostic Setup for this Pro Package is indicated by bold type.

Transducer	Diagnostic Setup
8661	**5.0MHz Vaginal,** 6.5MHz Vaginal, 7.5MHz Vaginal
8801	Fetal Heart, Gynecology, OB contrast, OB-pen, **OB-res**
8802	Fetal Heart, Gynecology, OB contrast, OB-pen, **OB-res**
8806	5.0MHz Vaginal, 6.5MHz Vaginal, **7.5MHz Vaginal,** 9.0MHz Vaginal

Table 18-1. Transducers and Diagnostic Setups for the OB/Gyn Pro Package.

Gestational Age and Expected Date of Confinement

You can calculate the gestational age (GA) and expected date of confinement (EDC) from measurements on the ultrasound image or from clinical parameters such as date of last menstrual period. You can also use the results of an earlier examination instead of the last menstrual period date to estimate the GA and EDC. Enter the information you want to use in the Patient window.

Patient Setup

The **Patient** window for this Pro Package contains some special fields. (See "Setting up a New Patient" on page 36 for information about using the **Patient** window.)

Field	Enter this information
Last Mens. Date	Date of last menstrual period (abbreviated LMP in reports)
Prev. Exam. Date	Date of exam with reference data.
Ref Data Method	Method to use for making clinical estimates of GA or EDC (CRL, BPD, FL, AC or HC).
Reference Data	Data to use for making clinical estimates of GA or EDC.
Menopause	Month/year of menopause
Length of Cycle	Number of days of menstrual cycle

Table 18-2. Special field in Patient window for OB/Gyn Pro Package.

> **NOTE:** *It is important to enter dates correctly. See "Entering Dates" on page 39.*

Labels and Bodymarks

This Pro Package contains a catalog of labels and bodymarks designed for OB/Gyn applications. Labels and bodymarks from other catalogs are also available when using the OB/Gyn Pro Package. See "Labelling Parts of the Image" on page 75 for information about using labels and "Using Bodymarks" on page 78 for information about using bodymarks.

Making Measurements

For detailed instructions for using the measuring tools, see "Measurements and Calculations" starting on page 87.

To make a measurement:

1. Click its name under **Measurements** to the right of the image. (Some of the measurements are contained in submenus.)

   If there is a triangle following the name of the measurement, click the triangle to see the various options for making that measurement. Click the option you want. A small green light appears to the left of the currently selected measurement in the list.

   If there are different results that can be shown, small green lights appear to the left of all the results that will be displayed. Click the name of the result to toggle results off or on.

   The appropriate measuring marker or tool appears on the image.

2. Position the marker where you want it (or draw with the drawing tool).

   If another marker is needed, it appears after you position the previous one.

3. Continue to position all needed markers.

After you have positioned all the markers, the result appears to the left of the image, at the bottom.

Measurement out of range

If the result of a measurement is outside the allowed range of values, this is indicated on the screen:

>>>> too high <<<< too low

If this happens, you may have made a mistake in your measurement or you may be trying to use a measurement that is inappropriate (for example, for the GA).

Calculation Methods

General Information

This Pro Package contains measuring tools that can be used to calculate gestational age (GA), fetal weight (FW), and expected date of confinement (EDC). The calculations are based on measurements of the ultrasound image such as biparietal diameter (BPD) or abdominal circumference (AC).

Measurement units

Unless otherwise noted, in this chapter GA is expressed in days, FW in grams (g), and distances are in millimeters (mm).

Obstetrics Measurements

Measurement	Methods	Other Results Displayed	Measuring Tool
CRL Crown Rump Length	Campbell DSOG Hadlock Hansmann Hobbins Jeanty Persson Robinson Tokyo	GA, EDC	Distance
BPD Biparietal Diameter	Campbell DSOG DSOG (BPD, FL) Eik-Nes Hadlock Hansmann Hobbins Jeanty Kurtz Persson Robinson Tokyo	GA, EDC (requires FL)	Distance
FL Femur Length	Campbell DSOG DSOG (BPD, FL) Hadlock Hansmann Persson Tokyo	GA, EDC (this one requires BPD)	Distance
AC Abdominal Circumference	Campbell Hadlock Jeanty	FW, GA, EDC	Ellipse, freehand, polygon or circle
AD Abdominal Diameter	Persson (AC)	GA, EDC	Ellipse (requires ellipse tool to be selected for AC measurement method)
	Persson (APD+ATD)	also MAD = (APD+ATD)/2	2 distances
CI Cephalic Index	HC	GA, EDC	Ellipse (requires ellipse tool to be selected for HC measurement method - see HC in Table 18-4).
	BPD/OFD	also BPD, OFD	2 distances

Measurement	Methods (continued)	Other Results Displayed	Measuring Tool
FW Fetal weight	Campbell (AC)	*	*
	DSOG (BPD, AD)	BPD, ATD, APD, MAD, GA, EDC	3 distances
Note: FW (using the default calculation method) is always displayed when the parameters necessary to calculate it have been measured.	DSOG (BPD, AD, FL)	BPD, ATD, APD, MAD, FL, GA, EDC	4 distances
	Eik-Nes (BPD, ATD)	BPD, ATD	2 distances
	Hadlock (AC, FL)	*	*
	Hadlock (AC, FL, BPD)	*	*
	Hansmann (BPD, TT)	BPD, TT, GA, EDC	2 distances
	Persson (BPD, AD)	BPD, ATD, APD, MAD, GA, EDC	3 distances
	Persson (BPD, AD, FL)	BPD, ATD, APD, MAD, FL, GA, EDC	4 distances
	Shepard (AC, BPD)	*	*
	Warsof (AC, BPD)	*	*

*When AC, HC and FL are used as part of a calculation, the measurement methods for AC, HC, and FL are the ones selected for measuring AC, HC and FL alone, and the measurements that are displayed are the ones for those methods.

Table 18-3. Obstetrics measurements in the OB/Gyn Pro Package.

Other OB Measurements

Measurement	Method	Other Results Displayed	Measuring Tool
AFI Amniotic Fluid Index	Sum of AFD (amniotic fluid distance)	AFD- measure 2, 3 or 4 to get AFI (sum)	1 distance for each AFD - click AFI for each one
OFD Occipitofrontal Diameter	Hansmann	GA, EDC	1 distance
TT Thorax Transverse Diameter	Hansmann	GA, EDC	1 distance
THAP Thorax Anteroposterior Diameter	Hansmann	GA, EDC	1 distance
HC Head Circumference	Campbell Hansmann Hadlock	GA, EDC	Ellipse, freehand, polygon, circle or BPD+OFD (2 distances)
VL Vertebrae Length	Tokyo	GA, EDC	1 distance
FBL Fibula Length	Hobbins	GA, EDC	1 distance
TBL Tibia Length	Hobbins	GA, EDC	1 distance
PL Foot Length	Hobbins	GA, EDC	1 distance
FL/AC		*	*
FL/BPD		* BPD, GA, EDC (from BPD)	*
HC/AC		*	*
ATD Abdominal Transverse Diameter		GA, EDC, MAD (requires APD)	1 distance

Measurement (continued)	Method (continued)	Other Results Displayed (continued)	Measuring Tool (continued)
APD Abdominal Anteroposterior Diameter		GA, EDC, MAD (requires ATD)	1 distance
GS Gestational Sac Diameter		GS average	Measure 1 distance, 2 distances, or 3 distances. For 3, click 1,2 ...and then ...3
GS Gestational Sac Diameter	Hansmann Hellman Tokyo	GA, EDC	up to 3 distances

*When AC, HC and FL are used as part of a calculation, the measurement methods for AC, HC, and FL are the ones selected for measuring AC, HC and FL alone, and the measurements that are displayed are the ones for those methods.

Table 18-4. Other Obstetrics measurements in the OB/Gyn Pro Package

Gynecology Measurements

Measurement	Method	Other results displayed	Measuring Tool
Endometrial Thickness (ET)		Avg. ET	Distance - measure several and get average
Uterine Height (Ut-H)			Distance
Uterine Width (Ut-W)			Distance
Uterine Length (Ut-L)		Volume (Ut-Vol if measure H, W and L)	Distance
Right Ovary Height (ROH)			Distance
Right Ovary Width (ROW)			Distance
Right Ovary Length (ROL)		Volume (RO-Vol if measure H, W and L)	Distance
Left Ovary Height (LOH)			Distance
Left Ovary Width (LOW)			Distance
Left Ovary Length (LOL)		Volume (LO-Vol if measure H, W and L)	Distance

Table 18-5. Gynecology measurements in the OB/Gyn Pro Package

NOTE: *Ovary and uterus volume measurements use the HWL factor specified on the* **Miscellaneous** *tab of the* **Measurements** *setup window. See page 188.*

IVF Measurements

Measurement	Method	Other results displayed	Measuring Tool
FD (1 distance)			Distance
FD (2 distances)			2 distances
FD (3 distances, 1, 2 ...)			2 distances (first 2 of 3)
FD (3 distances, ...3)		Avg. FD if measure 3.	1 distance (third of 3)

Table 18-6. IVF measurements (follicle diameter) in the OB/Gyn Pro Package

To measure the average of 3 follicle diameters:

1. Click **FD (3 distances, 1, 2 ...)**.
2. Measure 2 follicle diameters.
3. Change scanning plane and freeze the image.
4. Click **FD (3 distances, ...3)**.
5. Measure the third follicle diameter.

   The average (**Avg. FD**) appears with the measurements.

Obstetrics Reports

For information about reports, see “Reports” on page 114.

Obstetrics reports can contain the results of clinical calculations of GA and EDC as well as calculations based on measurements of the ultrasound image.

Editing a Report

You can edit a report before you save it. A saved report cannot be edited.

Adding remarks

You can add a remark to a report by putting the cursor in the Remarks field and typing the comment.

Deleting measure-ments

In an obstetrics report, you can delete some measurements. If you delete a measurement in a report, an average that uses it is recalculated in the report.

To delete a measurement from a report:

1. Point at the measurement result in the **Measurements** column.

   If the measurement is one that can be deleted, the measurement value is highlighted in red and crossed out.
2. Click.

   The measurement is removed from the report.

Curves in Reports

If you enter information in the **Patient** window about a previous measurement (CRL, BPD, FL, AC or HC) or the date of the last menstrual period, you can have a reference curves displayed as part of the report.

The **Curve Setup** window (see Fig 13-14 on page 185) contains a list of all available curves (including any user-defined ones). Some curves also have associated percentile curves – these will be displayed along with the main curve.

Each curve is on a separate page of the report. Click **Next** and **Previous** on the report to see the various pages.

Calculation Tables and Formulas

This section contains the tables and formulas that the system uses for obstetrical and gynecological calculations. References are listed at the end of the chapter. Information about the accuracy of the calculations begins on page 275.

Campbell

Campbell: GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
20	88	50	143	80	215
25	94	55	154	85	232
30	102	60	165	90	253
35	111	65	177	95	280
40	121	70	188		
45	132	75	201		

Table 18-7. Campbell. Gestational age (GA) calculated from biparietal diameter (BPD)

Campbell: GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
10	49	37	73	64	89
13	52	40	75	67	90
16	55	43	77	70	92
19	58	46	79	73	93
22	61	49	81	76	95
25	63	52	82	79	96
28	66	55	84	82	97
31	69	58	86	85	98
34	71	61	87		

Table 18-8. Campbell. Gestational age (GA) calculated from crown-rump length (CRL)

Campbell: GA from FL

FL [mm]	GA [Days]	FL [mm]	GA [Days]	FL [mm]	GA [Days]
10	89	35	148	60	220
15	101	40	161	65	238
20	112	45	175	70	259
25	123	50	189	75	287
30	135	55	204		

Table 18-9. Campbell. Gestational age (GA) calculated from femur length (FL)

Campbell: GA from HC

HC [mm]	GA [Days]	HC [mm]	GA [Days]	HC [mm]	GA [Days]
100	96	201	158	300	225
125	112	225	172	325	252
150	127	250	187	350	288
175	143	275	204		

Table 18-10. Campbell. Gestational age (GA) calculated from head circumference (HC)

Campbell: GA from AC

AC [mm]	GA [Days]	AC [mm]	GA [Days]	AC [mm]	GA [Days]
84	100	180	159	280	224
96	107	192	167	292	232
108	114	208	177	304	240
120	122	220	185	316	248
132	129	232	192	328	256
144	137	244	200	336	262
156	144	256	208		
168	152	268	216		

Table 18-11. Campbell. Gestational age (GA) calculated from abdominal circumference (AC)

Campbell: FW from AC

AC [mm]	FW [g]	AC [mm]	FW [g]	AC [mm]	FW [g]
210	899	280	2081	350	3472
220	1032	290	2283	360	3639
230	1179	300	2489	370	3789
240	1339	310	2695	380	3918
250	1510	320	2899	390	4023
260	1692	330	3098		
270	1883	340	3290		

Table 18-12.Campbell. Fetal weight (FW) calculated from abdominal circumference (AC)

DSOG (Danish Society of Obstetrics and Gynaecology)

DSOG CRL

DSOG GA from CRL

$$GA = 35.72 + (1.082 \times CRL^{0.5}) + (1.472 \times CRL) - (0.09749 \times CRL^{1.5})$$

Used for fetal age 5–12 weeks, with crown rump length 2–60 mm.

DSOG BPD

DSOG GA from BPD

$$GA = (BPD \times 2.1) + 39.1$$

Used for fetal age 12–15 weeks, with biparietal diameter 20–31 mm.

DSOG BPD/FL

DSOG GA from BPD and FL

$$GA = (BPD \times 1.21) + (FL \times 1.02) + 49.0$$

Used for fetal age 15–22 weeks, with biparietal diameter 32–50 mm and FL.

DSOG FL

DSOG GA from FL

$$GA = (FL \times 2.46) + 58.7$$

DSOG FW (BPD, AD)

DSOG FW from BPD and AD

$$FW = BPD^{1.321} \times AD^{1.833} \times 10^{-2.830}$$

DSOG FW (BPD, AD, FL)

DSOG FW from BPD, AD, and FL

$$FW = BPD^{0.972} \times AD^{1.743} \times FL^{0.367} \times 10^{-2.647}$$

Eik-Nes

Eik.Nes: GA from BPD

BPD [mm]	GA [Weeks]	BPD [mm]	GA [Weeks]	BPD [mm]	GA [Weeks]
35	15	64	24	89	33
37.5	16	67	25	91	34
40.5	17	70.5	26	93	35
43.5	18	73.5	27	95	36
46.5	19	76.5	28	96.5	37
50	20	79.5	29	97.5	38
53.5	21	82	30	99	39
57.5	22	84.5	31	100	40
61	23	87	32		

Table 18-13.Eik-Nes. Gestational age (GA) calculated from biparietal diameter (BPD)

Eik-Nes Calculation

Eik-Nes FW from ATP and BPD

Fetal Weight using ATD and BPD (measured in mm)

$$\mathrm{FW} = 1.43149 \times 0.001 \times \mathrm{BPD}^{1.85628} \times \mathrm{ATD}^{1.34008}$$

Hadlock

Hadlock: GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
20	86	48	144	76	215
24	93	52	153	80	227
28	101	56	162	84	240
32	109	60	172	88	253
36	118	64	182	92	266
40	126	68	193	96	280
44	135	72	204	100	294

Table 18-14.Hadlock. Gestational age (GA) calculated from biparietal diameter (BPD)

Hadlock: GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
2	40	34	72	66	90
6	45	38	75	70	92
10	50	42	78	74	94
14	54	46	80	78	97
18	58	50	82	82	100
22	62	54	84	86	102
26	66	58	86	87	104
30	69	62	88		

Table 18-15.Hadlock. Gestational age (GA) calculated from crown-rump length (CRL)

Hadlock: GA from FL

FL [mm]	GA [Days]	FL [mm]	GA [Days]	FL [mm]	GA [Days]
14	98	41	161	62	223
17	105	44	169	64	230
20	111	46	174	66	237
24	120	49	183	68	245
27	127	51	189	70	252
30	134	54	198	72	260
33	141	56	204	74	268
35	146	58	210	75	272
38	153	60	217	77	280

Table 18-16.Hadlock. Gestational age (GA) calculated from femur length (FL)

Hadlock: GA from HC

HC [mm]	GA [Days]	HC [mm]	GA [Days]	HC [mm]	GA [Days]
97	99	213	162	301	224
110	104	224	168	308	231
124	111	235	175	315	239
138	119	246	182	322	246
151	126	256	188	328	253
164	133	266	195	333	260
177	141	275	202	338	267
189	148	284	209	342	272
201	155	293	217	346	278

Table 18-17.Hadlock. Gestational age (GA) calculated from head circumference (HC)

Hadlock: GA from AC

AC [mm]	GA [Days]	AC [mm]	GA [Days]	AC [mm]	GA [Days]
73	99	185	160	281	225
86	105	197	168	291	232
99	112	208	175	300	239
112	119	219	182	309	245
125	126	230	189	318	252
137	132	240	196	327	259
150	140	251	203	336	266
162	147	261	210	344	272
174	154	271	217	353	279

Table 18-18.Hadlock. Gestational age (GA) calculated from abdominal circumference (AC)

Hadlock Calculations

Hadlock FW from AC and FL

Fetal Weight using AC and FL (measured in cm):

$$\log FW = 1.3598 + (0.051 \times AC) + (0.1844 \times FL) - (0.0037 \times AC \times FL)$$

Hadlock FW from BPD, AC and FL

Fetal Weight using BPD, AC and FL (measured in cm):

$$\log FW = 1.4787 - (0.003343 \times AC \times FL) + (0.001837 \times BPD^2) + (0.0458 \times AC) + (0.158 \times FL)$$

Hansmann

Hansmann
GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
25	87	55	151	85	227
30	96	60	162	90	242
35	107	65	174	95	260
40	117	70	185	100	278
44	127	74	197		
50	138	80	211		

Table 18-19.Hansmann. Gestational age (GA) calculated from biparietal diameter (BPD)

Hansmann
GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
6	43	30	72	80	99
8	46	40	79	90	104
12	52	50	85	100	110
15	56	60	90	110	116
20	62	70	94	120	123

Table 18-20.Hansmann. Gestational age (GA) calculated from crown-rump length (CRL)

Hansmann
GA from FL

FL [mm]	GA [Days]	FL [mm]	GA [Days]	FL [mm]	GA [Days]
10	90	35	147	60	218
15	101	40	161	65	234
20	112	45	174	70	252
25	123	50	189	75	273
30	135	55	203		

Table 18-21.Hansmann. Gestational age (GA) calculated from femur length (FL)

Hansmann
GA from GS

GS [mm]	GA [Days]	GS [mm]	GA [Days]	GS [mm]	GA [Days]
6	28	24	49	50	69
10	35	34	56	58	77
16	42	44	64	64	84

Table 18-22.Hansmann. Gestational age (GA) calculated from the size of the gestational sac (GS)

Hansmann
GA from OFD

OFD [mm]	GA [Days]	OFD [mm]	GA [Days]	OFD [mm]	GA [Days]
40	107	70	158	100	222
45	114	75	167	105	238
50	122	80	176	110	258
55	131	85	185	115	281
60	141	90	196		
65	150	95	208		

Table 18-23.Hansmann. Gestational age (GA) calculated from occipitofrontal diameter (OFD)

Hansmann
GA from TT

TT [mm]	GA [Days]	TT [mm]	GA [Days]	TT [mm]	GA [Days]
25	92	55	163	85	234
30	102	60	175	90	247
35	114	65	186	95	259
40	127	70	197	100	268
45	139	75	209		
50	152	80	221		

Table 18-24.Hansmann. Gestational age (GA) calculated from thorax transverse diameter (TT)

Hansmann GA from THAP

THAP [mm]	GA [Days]	THAP [mm]	GA [Days]	THAP [mm]	GA [Days]
25	96	55	168	85	238
30	108	60	180	90	251
35	120	65	192	95	268
40	132	70	204	99	286
45	144	75	215		
50	156	80	226		

Table 18-25.Hansmann. Gestational age (GA) calculated from thorax anteroposterior diameter (THAP)

Hansmann GA from HC

HC [mm]	GA [Days]	HC [mm]	GA [Days]	HC [mm]	GA [Days]
140	116	220	161	300	209
150	121	230	167	310	218
160	126	240	172	320	229
170	132	250	177	330	242
180	138	260	183	340	257
190	144	270	188	350	276
200	150	280	194		
210	155	290	201		

Table 18-26.Hansmann. Gestational age (GA) calculated from head circumference (HC)

Hansmann Calculations

Hansmann HC from BPD and OFD

HC calculated from BPD and OFD (measured in cm)

$$\mathrm{HC} = 2.325 \times \sqrt{\mathrm{BPD}^2 + \mathrm{OFD}^2}$$

Hansmann FW from BPD and OFD

Fetal Weight calculated from BPD and TT (measured in cm)

$$\mathrm{FW} = [(-1.05775 \times \mathrm{BPD}) + (0.649145 \times \mathrm{TT}) + (0.0930707 \times \mathrm{BPD}^2) - (0.020562 \times \mathrm{TT}^2) + 0.515263] \times 1000$$

Hellman

Hellman: GA from GS

GS [mm]	GA [Days]	GS [mm]	GA [Days]	GS [mm]	GA [Days]
10	35	28	53	46	71
12	37	30	55	48	73
14	39	32	57	50	75
16	41	34	59	52	77
18	43	36	61	54	79
20	45	38	63	56	81
22	47	40	65	58	83
24	49	42	67	60	85
26	51	44	69		

Table 18-27.Hellman. Gestational age (GA) calculated from the size of the gestational sac (GS)

Hobbins

Hobbins: GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
25	94	50	143	75	206
30	103	55	154	80	220
35	112	60	166	85	235
40	122	65	179	90	251
45	132	70	192	95	267

Table 18-28.Hobbins. Gestational age (GA) calculated from biparietal diameter (BPD)

Hobbins: GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
5	44	23	64	41	77
7	47	25	66	43	78
9	50	27	67	45	79
11	52	29	69	47	81
13	55	31	70	49	82
15	57	33	72	51	83
17	59	34	73	54	85
19	61	37	74		
21	62	39	76		

Table 18-29.Hobbins. Gestational age (GA) calculated from crown-rump length (CRL)

Hobbins: GA from FBL

FBL [mm]	GA [Days]	FBL [mm]	GA [Days]	FBL [mm]	GA [Days]
8	89	35	161	54	232
11	96	37	167	55	237
14	103	39	174	57	246
17	110	40	179	58	252
19	115	42	186	59	257
22	122	45	195	60	262
25	131	47	202	61	268
27	136	49	210	62	273
30	145	51	219	63	279
32	151	52	223		

Table 18-30.Hobbins. Gestational age (GA) calculated from fibula length (FBL)

Hobbins: GA from PL

PL [mm]	GA [Days]	PL [mm]	GA [Days]	PL [mm]	GA [Days]
7	77	34	142	61	218
10	88	37	149	64	227
13	97	40	156	67	236
16	105	43	164	70	244
19	112	46	172	73	253
22	118	49	181	76	261
25	124	52	190	79	269
28	130	55	199	82	277
31	136	58	208		

Table 18-31.Hobbins. Gestational age (GA) calculated from foot (pes) length (PL)

Hobbins: GA from TBL

TBL [mm]	GA [Days]	TBL [mm]	GA [Days]	TBL [mm]	GA [Days]
7	84	32	153	54	226
10	92	35	162	55	230
12	98	37	167	57	239
14	105	40	176	58	244
17	111	42	182	60	253
20	120	44	189	61	258
22	125	46	195	63	267
25	134	48	202	64	272
27	139	50	210	66	281
30	148	52	218		

Table 18-32.Hobbins. Gestational age (GA) calculated from tibia length (TBL)

Jeanty

Jeanty: GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
28	98	52	146	76	206
30	102	54	151	78	212
32	106	56	155	80	218
34	109	58	160	82	224
36	113	60	164	84	231
38	117	62	169	86	237
40	121	64	174	88	244
42	125	66	179	90	250
44	129	68	185	92	257
46	133	70	190	95	268
48	137	72	195		
50	142	74	201		

Table 18-33.Jeanty. Gestational age (GA) calculated from biparietal diameter (BPD)

Jeanty: GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
5	44	23	64	41	77
7	47	25	66	43	78
9	50	27	67	45	79
11	52	29	69	47	81
13	55	31	70	49	82
15	57	33	71	51	83
17	59	35	73	54	85
19	61	37	74		
21	62	39	76		

Table 18-34.Jeanty. Gestational age (GA) calculated from crown-rump length (CRL)

Jeanty: GA from AC

AC [mm]	GA [Days]	AC [mm]	GA [Days]	AC [mm]	GA [Days]
57	84	163	154	262	223
67	91	173	161	271	231
77	98	184	168	279	238
88	105	195	175	286	245
98	112	205	182	293	252
109	119	215	189	300	260
119	126	225	196	306	267
130	133	235	203	311	273
141	140	244	210	316	280
152	147	254	217		

Table 18-35.Jeanty. Gestational age (GA) calculated from abdominal circumference (AC)

Kurtz

Kurtz
GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
27	98	57	161	81	224
31	106	60	168	83	231
34	111	63	175	85	237
38	119	66	182	87	245
41	125	69	190	89	252
45	134	71	195	91	261
48	140	74	203	92	265
51	147	76	209	94	274
54	154	79	218	95	279

Table 18-36.Kurtz. Gestational age (GA) calculated from biparietal diameter (BPD)

Persson

Persson
GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
10	54	40	76	64	90
15	58	45	80	68	92
25	66	50	83	72	94
30	69	56	86	76	96
35	73	60	88	80	98

Table 18-37.Persson. Gestational age (GA) calculated from crown rump length (CRL).

Persson
GA from BPD

$$GA = (2.405 \times BPD) - (0.015 \times BPD^2) + (0.000165 \times BPD^3) + 40.1$$

Persson
GA from FL

$$GA = (6.95 \times FL) - (0.202 \times FL^2) + (0.00337 \times FL^3) - (0.0000181 \times FL^4) + 30.7$$

Persson
FW from
BPD and AD

$$FW = \frac{BPD^{1.3211} \times AD^{1.8327}}{10^{2.8299}}$$

Persson
FW from
BPD, AD, FL

$$FW = \frac{BPD^{0.9721} \times AD^{1.7430} \times FL^{0.3668}}{10^{2.6465}}$$

Persson
GA from AD

AD [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
35	113	60	163	85	213
36	115	61	165	86	215
37	117	62	167	87	217
38	119	63	169	88	219
39	121	64	171	89	221
40	123	65	173	90	223
41	125	66	175	92	228
42	127	67	177	93	230
43	129	68	179	94	232
44	131	69	181	96	237
45	133	70	183	97	239
46	135	71	185	98	241
47	137	72	187	100	246
48	139	73	189	101	248
49	141	74	191	103	253
50	143	75	193	104	255
51	145	76	195	105	257
52	147	77	197	106	260
53	149	78	199	107	262
54	151	79	201	109	267
55	153	80	203	110	270
56	155	81	205	111	273
57	157	82	207	112	276
58	159	83	209	113	279
59	161	84	211		

Table 18-38.Persson. Gestational age (GA) calculated from abdominal diameter (AD).

Robinson

Robinson GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
20	85	48	143	76	216
24	93	52	153	80	228
28	101	56	162	84	240
32	109	60	172	88	253
36	118	64	182	92	266
40	126	68	193	96	280
44	135	72	204		

Table 18-39.Robinson. Gestational age (GA) calculated from biparietal diameter (BPD)

Robinson GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
4	42	32	71	60	88
8	48	36	74	64	90
12	53	40	76	68	92
16	58	44	79	72	94
20	61	48	81	76	96
24	65	52	84	80	98
28	68	56	86		

Table 18-40.Robinson. Gestational age (GA) calculated from crown-rump length (CRL)

Shepard

Shepard Calculation

Fetal Weight using BPD and AC (measured in cm)

Shepard FW from BPD and AC

$$\log \mathrm{FW} = 1.2508 + (0.166 \times \mathrm{BPD}) + (0.046 \times \mathrm{AC}) - (0.00264 \times \mathrm{BPD} \times \mathrm{AC})$$

Tokyo

Norio Shinozuka, Haruo Masuda, Hideyuki Kagawa, and Yuji Taketani. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo

Tokyo
GA from BPD

BPD [mm]	GA [Days]	BPD [mm]	GA [Days]	BPD [mm]	GA [Days]
20	84	53	153	79	222
24	91	56	161	82	232
27	98	59	168	84	240
31	105	62	176	85	244
34	112	65	184	87	254
38	120	67	189	88	259
41	127	70	197	89	266
44	133	72	202	90	272
47	139	75	210		
50	146	77	216		

Table 18-41.Tokyo. Gestational age (GA) calculated from biparietal diameter (BPD)

Tokyo
GA from CRL

CRL [mm]	GA [Days]	CRL [mm]	GA [Days]	CRL [mm]	GA [Days]
15	56	46	84	98	112
19	62	57	91	103	119
27	70	72	98		
36	77	87	105		

Table 18-42.Tokyo. Gestational age (GA) calculated from crown-rump length (CRL)

Tokyo
GA from FL

FL [mm]	GA [Days]	FL [mm]	GA [Days]	FL [mm]	GA [Days]
31	140	48	189	62	237
33	147	50	195	64	246
35	154	52	201	65	250
38	162	55	211	67	261
40	167	57	218	68	266
43	175	59	225	69	273
46	183	60	229	70	280

Table 18-43.Tokyo. Gestational age (GA) calculated from femur length (FL)

Tokyo
GA from GS

GS [mm]	GA [Days]	GS [mm]	GA [Days]	GS [mm]	GA [Days]
10	28	27	48	48	70
16	35	34	56	57	77
22	42	41	63	67	84

Table 18-44.Tokyo. Gestational age (GA) calculated from gestational sac (GS)

Tokyo
GA from VL

VL [mm]	GA [Days]	VL [mm]	GA [Days]	VL [mm]	GA [Days]
37	148	59	196	75	246
40	153	62	203	77	255
44	161	64	208	78	260
47	167	67	217	79	266
50	174	69	223	80	272
54	184	71	230	81	278
57	191	73	237		

Table 18-45.Tokyo. Gestational age (GA) calculated from length of vertebrae (VL)

Warsof

Warsof Calculation

Fetal Weight using BPD and AC (measured in cm):

Warsof
FW from BPD
and AC

$$\log \mathrm{FW} = 1.401 + (0.144 \times \mathrm{BPD}) + (0.032 \times \mathrm{AC}) - \frac{0.111(\mathrm{BPD}^2 \times \mathrm{AC})}{1000}$$

Calculation Accuracy

Factors Affecting Accuracy

The input parameters used in the obstetrical calculations are measured distances (for example, BPD), measured circumferences (for example, AC) or an entered LMP date. These parameters are used to calculate fetal weight (FW), gestational age (GA) and expected date of confinement (EDC).

The calculation accuracy is influenced by:

- the accuracy of the measured input parameters
- the accuracy of the calculation methods
- rounding.

Accuracy of Measured Input Parameters

The measurement accuracy of distances or circumferences is stated for each transducer type in the *General Transducer User Guide*.

Accuracy of Calculation Methods

Errors introduced by the calculation methods are **not** taken into account as **system errors** - they depend statistically on a specific study and population. These errors are highlighted in the references [1-25].

Rounding

Rounded numbers are shown on the screen and in the OB report, but internally, floating point values are used to calculate FW and GA. Thus rounding errors in calculations are negligible compared to the other error sources.

> **NOTE:** *It is the responsibility of the physician to evaluate accuracies in each specific patient case.*

References

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[25] Williams RL et al. Obstet. Gynecol. 59 (1982), 624-632.

Chapter 19
Cardiac Pro Package

Introduction

This Pro Package contains:

- Diagnostic Setups
- labels and bodymarks
- a report
- measuring tools and calculations

used in cardiac ultrasound applications.

Before using this Pro Package, you should be familiar with the information in previous chapters, particularly Chapter 4, “Working with the Image” and Chapter 11, “Doppler Mode – Spectral Doppler”.

Abbreviations used in measurements and calculations are defined in the Glossary, starting on page 315.

The information in this chapter may not correspond to the Pro Package on your scanner because Pro Packages can be customized. (See Chapter 13, “Setting Up and Customizing Your System”.)

Transducers and Diagnostic Setups

This Pro Package supports the following B-K Medical transducer types and Diagnostic Setups.

Transducer	Diagnostic Setup
8817	**Cardiac**

Table 19-1. Transducers and Diagnostic Setups for the Cardiac Pro Package

Patient Setup

The **Patient** window for this Pro Package contains some special fields. (See “Setting up a New Patient” on page 36 for information about using the Patient window.)

Field	Enter this information
Height (m)	Height of patient measured in meters
Weight (kg)	Weight of patient measured in kilograms

Table 19-2. Special field in Patient window for Cardiac Pro Package.

Labels and Bodymarks

This Pro Package contains a catalog of labels and bodymarks designed for Cardiac applications. Labels and bodymarks from other catalogs are also available when using the Cardiac Pro Package. See “Labelling Parts of the Image” on page 75 for information about using labels and “Using Bodymarks” on page 78 for information about using bodymarks.

Reports

For information about Cardiac reports, see “Reports” on page 114.

Cine (Image Review)

Cine (image review) lets you review a series of the most recently recorded images in this Pro Package. For information about how to review, or make measurements from, a cine image see “Cine” on page 80.

Making Measurements

For detailed instructions for using the measuring tools, see “Measurements and Calculations” starting on page 87.

To make a measurement:

1 Click its name under **Measurements** to the right of the image. (Some of the measurements are contained in submenus.)

If there is a triangle following the name of the measurement, click the triangle to see the various options for making that measurement. Click the option you want. A small green light appears to the left of the currently selected measurement in the list.

The appropriate measuring marker or tool appears on the image.

2 Position the marker where you want it (or draw with the drawing tool).

If another marker is needed, it appears after you position the previous one.

3 Continue to position all required markers.

After you have positioned all the markers, the result appears to the left of the image, at the bottom.

B-Mode Measurements

Measurement	Description	Measuring Tool
General		
Distance	Distance between two markers	2 markers
Ellipse	Diameter, area and volume	Ellipse
Circle	Circumference, area, diameter and volume	Circle
Freehand	Circumference and area	Freehand
LV Bullet		
LVLd	Left Ventricular Length, diastole	2 markers
LVLs	Left Ventricular Length, systole	2 markers
LVAd	Left Ventricular Area, diastole	Ellipse or freehand
LVAs	Left Ventricular Area, systole	Ellipse or freehand
SI	Stroke Volume Index	
LV		
IVSd	Interventricular Septal Thickness, diastole	2 markers
LVDd	Left Ventricular Internal Diameter, diastole	2 markers
LVPWd	Left Ventricle Posterior Wall Thickness, diastole	2 markers
IVSs	Interventricular Septal Thickness, systole	2 markers
LVDs	Left Ventricle Internal, systole	2 markers
LVPWs	Left Ventricle Posterior Wall Thickness, systole	2 markers
Aortic Valve B		
AO diameter d	Aortic Root Dimension, diastole	2 markers
RVOT diameter d	Right Ventricular Outflow Tract Diameter, diastole	2 markers
AO diameter s	Aortic Root Dimension, systole	2 markers
LA diameter s	Left Atrium Medial Lateral diameter, systole	2 markers
LAD/AOD	Left Atrium Diameter/Aortic Root Diameter Systole	2 sets of 2 markers

Measurement	Description (continued)	Measuring Tool
LVOT diameter s	Left Ventricular Outflow Tract Diameter, systole	2 markers
RVOT diameter s	Right Ventricular Outflow Tract Diameter, systole	2 markers

Table 19-3. B-mode measurements in the Cardiac Pro Package.

Doppler Mode Measurements

If the Doppler angle correction is turned on, the measurements are in cm/s; if it is turned off, the measurements are in kHz. For information about the Doppler correction angle and how to change it, see “Angle Correction” on page 156.

Measurement	Description	Measuring Tool
General		
V1, V2	Velocity at position of marker 1 or 2	1 marker for each
V1/V2	V1/V2	1 marker for each
dV	Velocity difference	2 markers
Acc		2 markers
HR (3)	Heart rate (based on 3 cycles)	2 vertical lines
Mitral Valve D		
PFV MV	Peak Flow Velocity, Mitral Valve	Freehand
PFV LA	Peak Flow Velocity, Left Atrium	1 marker
VTI MV	Mitral Valve Velocity Time Integral	2 vertical lines
PHT MV	Mitral Valve Pressure Half Time	2 markers
Acc T	Flow Acceleration Time	2 vertical lines
Dec T	Flow Deceleration Time	2 vertical lines
ET	Ejection Time	2 vertical lines
Aortic Valve D		
PFV AV	Aortic Valve Peak Flow Velocity	1 marker
VTI AV	Aortic Valve Velocity Time Integral	Freehand
ET	Ejection Time	2 vertical lines
PFV LVOT	Left Ventricle Outflow Tract Peak Flow Velocity	1 marker
VTI LVOT	Left Ventricle Outflow Tract Velocity Time Integral	Freehand between two vertical lines
LVOT diameter s	Left Ventricle Outflow Tract Diameter, systole	Freehand between two vertical lines
Pulmonic Valve D		
PFV PV	Pulmonic Valve Peak Flow Velocity	Freehand
VTI PV	Pulmonic Valve Velocity Time Integral	2 markers
RVOT diameter s	Right Ventricle Outflow Tract Diameter, systole	2 markers (in B-mode image)
Tricuspidal Valve		
PFV TV	Tricuspid Valve Peak Flow Velocity	Freehand

Measurement	Description (continued)	Measuring Tool
RI/PI		
PS	Peak systolic velocity	1 marker
ED	End diastolic velocity	1 marker
RI	Resistance Index	(PS-ED)/PS (Measure PS, then ED)
PS/ED	(Peak Systolic Velocity)/ (End Diastolic Velocity)	PS/ED (Measure PS, then ED)
Auto	PS, ED, RI, PS/ED	

Table 19-4. Doppler mode measurements in the Cardiac Pro Package.

M-Mode Measurements

Measurement	Description	Measuring Tool
LV Teichholz		
LV All	6 Measurements	2 Markers
IVSd	Interventricular Septal Thickness, diastole	2 Markers
LVDd	Left Ventricular Internal Diameter, diastole	2 Markers
LVPWd	Left Ventricle Posterior Wall Thickness, diastole	2 Markers
RVDd	Right Ventricle Internal Diameter, diastole	2 Markers
IVSs	Interventricular Septal Thickness, systole	2 Markers
LVDs	Left Ventricular Internal Diameter, systole	2 Markers
LVPWs	Left Ventricle Posterior Wall Thickness, systole	2 Markers
RVDs	Right Ventricle Internal Diameter, systole	2 Markers
HR (3)	Heart Rate (based on 3 cycles)	2 vertical lines
Mitral Valve M		
All Points		5 Points
Aortic Valve M		
AOd	Aortic Root Dimension, diastole	
ALSs	Aortic Valve Leaflet Separation, systole	
LADs	Left Atrium Dimension, systole	

Table 19-5. M-mode measurements in the Cardiac Pro Package.

NOTE: *All Doppler measurements (except for real-time measurements) are made on a frozen Doppler recording.*

ECG

The ElectroCardioGram (ECG) module enables the user to synchronize the ultrasound image acquisition to the heartbeat.

ECG is available in B-mode, Color, Doppler and M-mode.

ECG is not available when using Split Screen.

The ECG module for the Pro Focus can be purchased as an option. For more information, see Appendix C, “Specifications”.

WARNING Do not use the ECG module UA2203 for diagnostic or monitoring purposes. It is intended for correlation of heart cycle to ultrasound imaging only.

Connecting the Electrodes

The ECG socket for connecting the ECG electrodes is on the front of the scanner (see Fig 19-1).

The ECG electrodes and electrode connector cable can be purchased from B-K Medical. For more information, see Appendix C, “Specifications”.

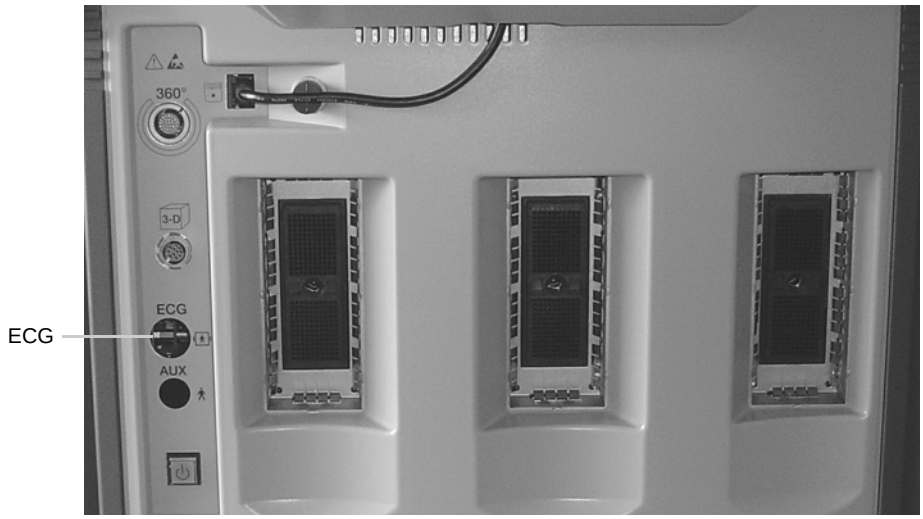


Figure 19-1. Connecting the ECG electrodes to the scanner.

WARNING Not for direct cardiac application.

WARNING Remove the ECG electrodes from the patient before using a defibrillator.

WARNING The conductive parts of the electrodes including the black neutral electrode, must not come into contact with any other conductive parts, including ground.

WARNING Do not use on a patient who has a cardiac pacemaker fitted.

WARNING The clips for attaching the electrodes to the patient are color-coded. When attaching the electrodes, ensure that the correct color matches the correct body part:

- red - right arm
- yellow - left arm
- black - right leg

Checking the Cables

Caution: The electrode cable should be checked regularly for cracks and wear.

Caution: Use the electrode cable supplied by B-K Medical when using the ECG module.

Using ECG

When using ECG in B-mode, a graphical recording of the patient's electrocardiogram is overlaid on the ultrasound image. If you are using Doppler, CW Doppler or M-mode, the ECG curve will be overlaid on the Doppler, CW Doppler or M-mode image.

To turn ECG on and off:

- Click on **ECG** under **Image** on the right side of the screen.
  NOTE: *Pressing* [▱▱] *will also turn off* **ECG**.

Sweep Speed

You can adjust the time it takes for the ECG curve to sweep from left to right across the image.

To adjust sweep speed:

- Click **Sweep** on the right side of the screen and drag to select the required speed.
  The available values range from 2 seconds to 8 seconds.

ECG Size

You can change the size of the displayed ECG curve.

To adjust ECG size:

- Click **Size** on the right side of the screen and drag to select the required size.
  The available values range from 0 (smallest) to 2 (largest).

ECG Offset

ECG offset changes the position of the displayed ECG curve.

To adjust ECG offset:

- Click **Offset** on the right side of the screen and drag to select the required value.

  The available values range from 0 (nearest to the top of the image) to 4 (nearest to the bottom of the image).

Heart Rate

You can control the number of cycles over which HR is averaged.

To adjust HR average length:

- Click **Heart Rate** and drag to select the required number of cycles.

Refractory Time

Refractory time sets the period following the R-peak in which no new R-peak is acknowledged. This can be used to discriminate the R-peak from the S-peak in difficult situations.

To adjust refractory time:

- Click **Hold** on the right side of the screen and drag to the required value.

  The available values range from 0 to 2000 ms in steps of 100ms.

Reviewing ECG

The ECG curve can be stored and reviewed with a cine recording. For information about using Cine see See “Cine” on page 80.

Chapter 20
3D Imaging

Introduction to 3D Ultrasound

The basic concept of 3D ultrasound is to collect a data set of 2D ultrasound images (black & white or color) while tracking and storing the location of each individual 2D image. The data set is then reconstructed into a single 3D volume that can be displayed on the screen and manipulated. The reconstructed 3D volume can be rotated, sliced, rendered or displayed in multiplane cross-sections.

3D on the Pro Focus

The 3D function of the Pro Focus can be purchased as an option. For more information, see “Specifications” on page 335.

To run the 3D software, you must have a license from B-K Medical. For information about activating the 3D option, see “Licenses” on page 196.

Password Protection

If your patient archiving system is password protected (see “Password Protection of the Database” on page 115), you cannot use the 3D system unless you are logged in.

Emergency

In an emergency, you can put the scanner into an Emergency state and acquire 3D data sets, but you cannot save them with any patient ID other than **EmergencyID**. See “Emergency State” on page 116.

Scanning Modes

You can use 3D with B-mode, Color mode or Power mode scanning. However, you cannot use 3D with the following modes and functions:

- Doppler mode (spectral PW Doppler)
- CW Doppler
- M-mode
- Split-screen
- Color mode (velocity + variance submode)
- Power mode (power + velocity submode)
- ECG
- B Color

NOTE: *Turning on one of these modes or functions while you are using 3D will turn off the 3D system. If you are already using one of these modes, turning on 3D on will turn the mode or function off, and turning off 3D will not turn it on again.*

Controlling Transducer Movement

The 2D images in the data set are scanned with the transducer in different positions. The transducer can be moved in the following ways:

- with a computer-controlled positioning device (external or built into the transducer)
- untracked freehand (see second warning on page 293)

Computer-Controlled Positioning

If the transducer is moved with a computer-controlled positioning device, you can make measurements on the reconstructed 3D volume. There are 3 types of computer-controlled positioning devices you can use:

- the built-in 3D mover in the 2050 transducer
- the pullback mover for the 1850 and 8808 transducers
- the endocavity rotational mover (ECRM) for the 8658 biplane transducer

Anorectal Transducer 2050

The 2050 transducer has a built-in mover for 3D acquisition. For information about setting up and attaching the 2050 transducer, see the 2050 transducer user guide.

The Pullback Mover

The pullback mover (UA0552) is designed for use with the 1850 and 8808 transducers. The mover is a computer-controlled, motor-driven probe positioner used to move the transducer backward to produce a series of parallel images. For information about setting it up, see the relevant transducer guide.

Figure 20-1. The pullback mover with the 1850 transducer.

Caution: The pullback mover is transducer-specific. Do not use it with other transducers than the ones it is intended for.

WARNING Do not put your fingers where they can be pinched when the mover moves back toward you.

Endocavity Rotational Mover (ECRM)

The ECRM is a probe positioner that rotates an endocavity transducer about its long axis, creating a fanned data set. This positioner is for use with the 8658 biplane transducer.

The ECRM consists of:

- a computer-controlled mover (UA0550)
- a transducer cradle (UA0551)

Figure 20-2. The ECRM.

Caution: The cradle is specifically designed for the 8658 transducer. Do not interchange transducers and cradles.

Setting Up the ECRM

To attach the cradle to the mover:

1. Use the 2 alignment pins to attach the cradle to the mover.
2. Tighten the captured screw to hold the cradle and mover firmly together.

Figure 20-3. Attaching the cradle to the mover.

To detach the cradle from the mover:

- Turn the screw counterclockwise until the 2 components separate.

  The transducer should fit tightly into the cradle (see Fig 20-5).

To mount the transducer:

1. Slide the 8658 transducer into the cradle while you align the pin on the transducer with the groove on the cradle.
2. Make sure that the transducer is fully inserted in the groove.

Attachment pin (for biopsy attachment) on the 8658 transducer slides into cradle groove.
NOTE: The clip for the attachment pin has been removed for clarity.

Figure 20-4. Mounting the transducer in the cradle.

3 Use the clip to secure the transducer in the cradle. The clip covers the attachment pin on the transducer and automatically clicks into place when the transducer is aligned to the cradle.

Releasing the transducer

To release the transducer, lift the clip and slide the transducer out of the holder.

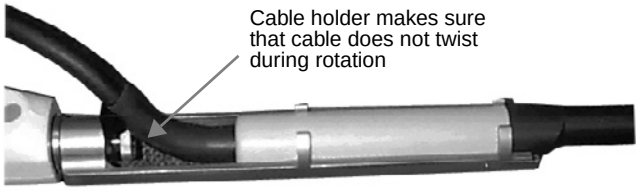


Figure 20-5. Transducer Type 8658 mounted in the cradle.

Make sure that the ECRM cables and transducer can move freely while you scan an image. Make sure that the cable length from the scanner to the ECRM is long enough to allow full and smooth rotation.

Hold the cable with your left hand while you support the ECRM with your right hand. As the ECRM rotates, collecting data, the cable wraps around the ECRM handle.

Connecting to the scanner

To connect the ECRM to the scanner:

- Plug it into the mover socket on the scanner front. See Fig 2-5 on page 41.

Operating the ECRM

Two of the buttons on the ECRM handle are used to control 3D scan operations (see Fig 20-6). The other two buttons have no function with this scanner.

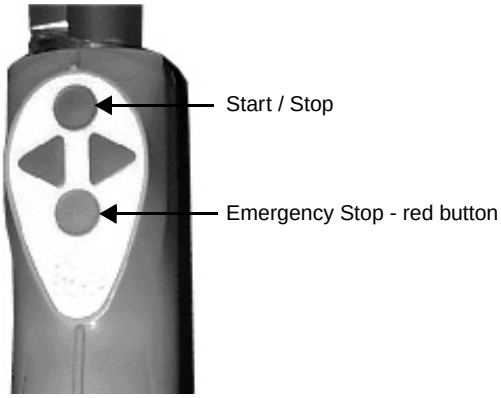


Figure 20-6. Control buttons on ECRM handle.

WARNING Do not push the probe hard against the patient because doing so may deform the structure being imaged or stall the positioner.

Caution: If the mover is dropped or subjected to mechanical shock, contact your local B-K Medical service representative to check and confirm the unit's proper operation and accurate calibration.

Cleaning the ECRM

For information about cleaning the ECRM, see page 204.

Untracked Freehand

The transducer is moved freely by the user.

WARNING You cannot make accurate measurements on a 3D data set acquired using the untracked freehand method.

If you start to make a measurement on a 3D data set acquired using the untracked freehand method, the following warning appears in red on the screen to remind you that the measurement will not be accurate.

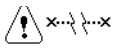


Figure 20-7. 3D untracked freehand measurement warning on the screen.

3D Scanning Overview

Here is an overview of the steps involved in acquiring a 3D data set. The rest of this chapter contains detailed information about the procedures.

To make a 3D scan:

1. Check all the connections.
2. Connect the relevant mover, if needed.
3. Choose the Diagnostic Setup you want.
4. Optimize the 2D image.
5. Turn on 3D. If you have not entered a Patient ID, the **Patient** window opens.
6. Set the image capture settings that you want.
7. Adjust the ROI markers to include the area of interest to be scanned.

   Once you have defined the image capture settings, you can begin scanning.
8. Press [3D] or click or **Acquire**.

   NOTE: *You can also use the* **Start/Stop** *button on the ECRM to start and stop scanning. The ECRM's red button is for emergency stops.*

   The time taken to complete the scan depends on the chosen frame rate, step size and scan extent. To stop the scan at any time, click **Stop** next to the progress bar.

9 If you have not scanned the entire region of interest, reposition the transducer and reset the scanning parameters (if required). Press [3D] or click or **Acquire** to start scanning a new 3D image.

Turning 3D On and Off

NOTE: *You cannot turn on 3D if the scanned image is frozen.*

To turn on 3D:

- Press [3D].

or

- Click .

You can also use set up a user-defined key (or foot-pedal switch) to start 3D. See “User-Defined Keys” on page 169.

If you have not entered a valid patient ID, you will be prompted to do so.

NOTE: *You cannot acquire 3D data sets unless you have entered a patient ID. The default patient ID is “NoID”.*

To turn off 3D:

- Press (long) [3D] or the user-defined 3D key.

or

- Click (long) .

Setting Up the Image Capture Settings

When you turn 3D on, the **3D Acquisition** window appears:

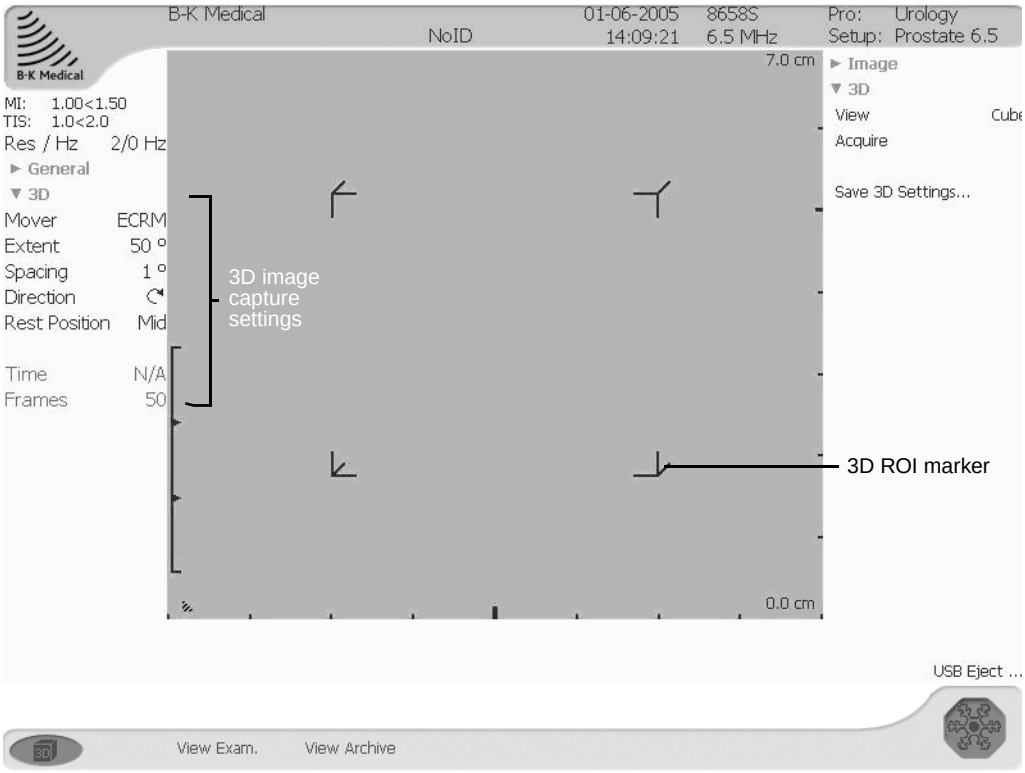


Figure 20-8. The 3D Setup window.

In the **3D Setup** window, 3D image capture settings are listed under **3D** on the left side of the screen. On the right side of the screen, under **3D**, are some other 3D settings (see page 297). The ROI markers in the scan area indicate the area that will be captured in the 3D data set.

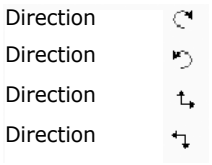
3D Image Capture Settings	Description
Mover	Mover type
Extent	Extent of the scan.
Spacing	Spacing between frames of the 3D acquisition.
Direction	Scanning direction. See below.
Rest Position	This sets the rest position of the transducer when you are using the ECRM. See page 296.
Time	Time required for the acquisition. You cannot change this directly.
Frames	Number of frames in the acquisition. You cannot change this directly.

Table 20-1. 3D image capture settings.

Setting the Scanning Direction

Set direction carefully

You must select the scanning direction to match the direction that the transducer is moving during acquisition. This is essential for making sure that the 3D volume is reconstructed correctly.



Clockwise (ECRM or fanned)
Counterclockwise (ECRM or fanned)
Superior to Inferior or Left to Right* (linear or pullback)
Inferior to Superior or Right to Left* (linear or pullback)

*The directions are defined relative to a patient lying on his or her back.

Figure 20-9. 3D scanning directions.

Setting the Rest Position

The ECRM has 3 rest positions: **Mid** (default), **Start** and **End**. You set one of these to specify the action of the ECRM when scanning takes place.

Rest Position	Position scanning plane here on the anatomy of interest before you start to acquire a 3D data set	Action of the transducer and ECRM
Mid (default)	Middle of anatomical object.	Move quickly to **Start** position, scan while rotating to **End** position, move quickly back to **Mid** position.
Start	Edge of anatomical object where data acquisition will begin	Start scanning immediately while rotating to **End** position, move quickly back to **Start** position when done.
End	Edge of anatomical object where data acquisition will end	Move quickly to **Start** position, then start scanning while rotating to **End** position.

Table 20-2. The possible Rest Position settings for the ECRM.

ROI (3D Region of Interest)

The 3D region of interest (ROI) box defines the area that is captured with a 3D scan.

> **NOTE:** *You cannot press [🔍] to activate the 3D ROI box. The [🔍] key continues to work in the normal way for the 2D scan.*

Moving the ROI box

To move the 3D ROI box to a different part of the image, click inside the box to select it and drag it with the trackball. Click to release the cursor when the box is where you want it.

Resizing the ROI box

To resize the box (increase or decrease the area covered by the 3D acquisition), press +/- when the box is selected.

You can also resize the box by clicking one of the corners (selecting it) and then dragging the corner.

Other 3D Settings

In the **3D Setup** window, under **3D** on the right side of the screen, you can click:

- **Acquire** to start to acquire a 3D data set
- **View** to select a view that appears when acquisition is complete. (The one you last viewed is selected. When you point at it, a triangle appears to the right. Click to select a different view. Then click **View**.) See below.
- **Save 3D Settings...** to save your setup. See below.

Selecting a View

You can specify the view that will appear after you have acquired the 3D data set.

To the right of **View** under **3D** on the right side of the screen, is the view that will appear. If you want a different view, click the triangle to the right to select from a list.

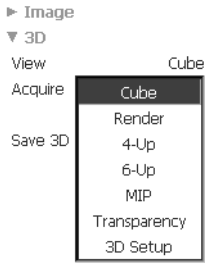


Figure 20-10. 3D data set views.

If you click **3D Setup**, no 3D view automatically appears after the data set is acquired.

Saving 3D Settings

When you finish setting up the 3D acquisition, you can save the 3D settings just as you save any other Diagnostic Setup (see “Saving a Diagnostic Setup” on page 43. Click **Save 3D Settings...** under 3D on the right side of the screen. The **Save Diagnostic Setups** window opens:

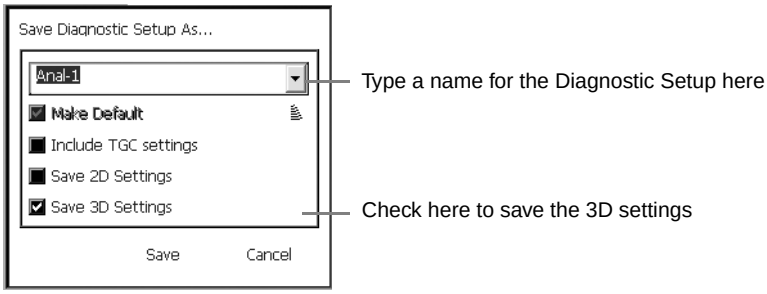


Figure 20-11. The Save Diagnostic Setups window.

A Diagnostic Setup includes both 2D and 3D settings. In the **Diagnostic Setups** window, you specify whether you want to save 2D settings, 3D settings or both. You can overwrite the settings for the named Diagnostic Setup, or you can save the settings you want with a new name.

Starting a 3D Acquisition

Starting 3D acquisition

To start the 3D acquisition:

- Press [3D].

or

- Click 3D or **Acquire**.

or

- Press a user-defined key.

A progress bar appears.

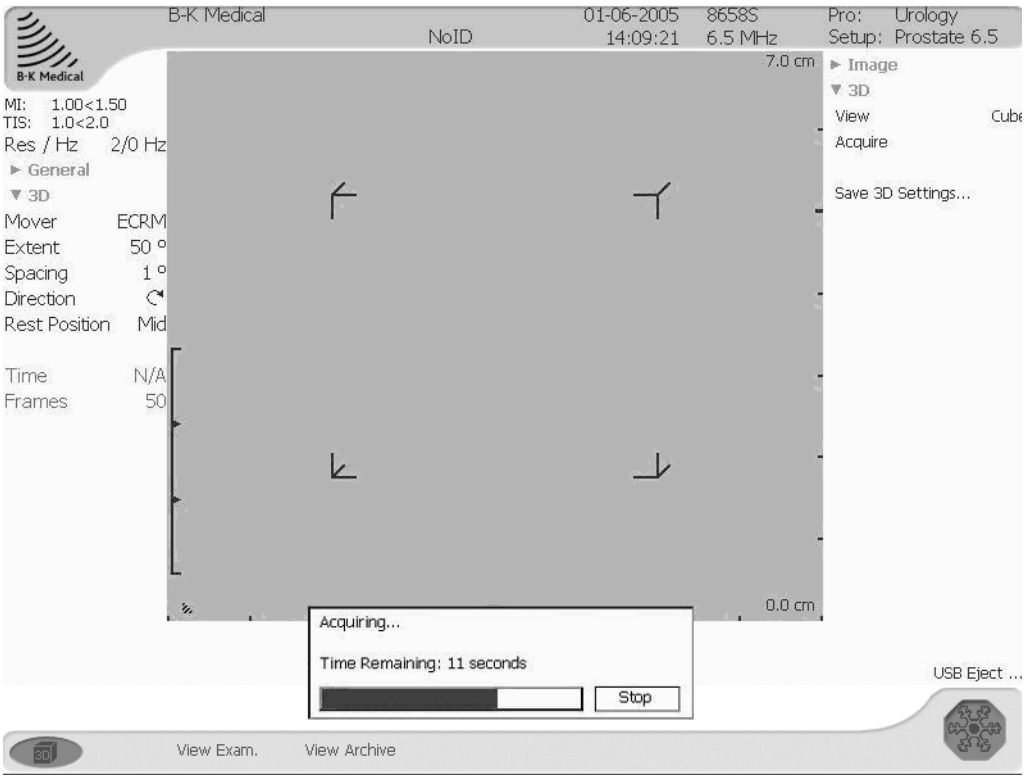


Figure 20-12. The 3D Acquisition window with progress bar.

> **NOTE:** *During 3D acquisition, most keys and on-screen controls are disabled. You can use only the* FREEZE *function (screen or control panel), and* [3D] or [↶] *on the control panel.*

Aborting 3D acquisition

To abort a 3D acquisition (stop it before it is finished):

- Press [3D] or [↶] or [❁] or the user-defined 3D key.

or

- Click **Stop** next to the progress bar.

After you have acquired a 3D data set, it is displayed as a volume in the image area. You can select various ways of viewing the volume, and you can use various tools and settings to enhance the image.

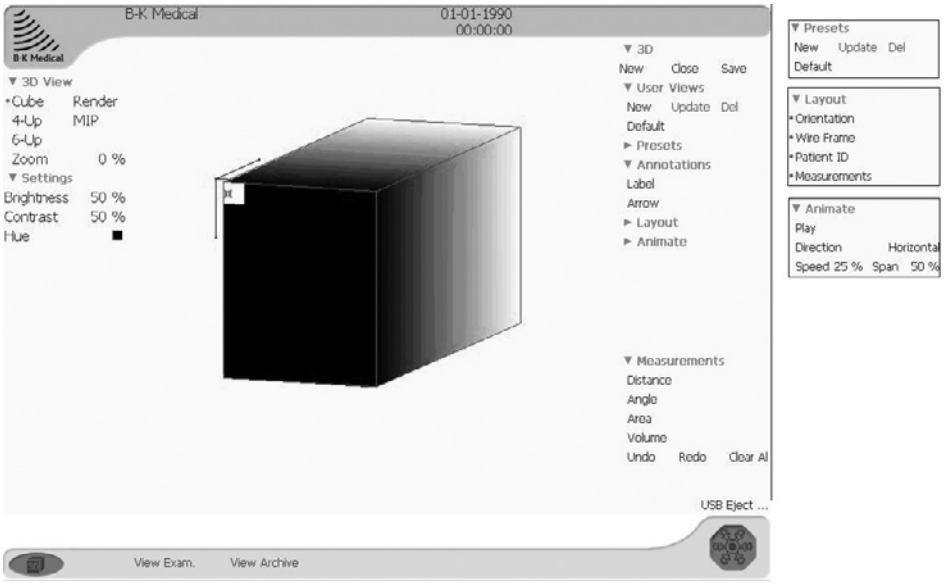


Figure 20-13. Viewing a 3D volume.

Viewing a 3D Data Set

There are 6 different ways you can view the 3D data set. They are described later in this chapter.

- Cube (see page 304)
- Render (see page 307)
- MIP – Maximum Intensity Projection (see page 309)
- Transparency (see page 310)
- 4-Up (see page 311)
- 6-Up (see page 312)

Before you acquire the 3D data set, you can select the view that appears when acquisition is complete. See “Selecting a View” on page 297..

3D – New, Close, Save

When you view a 3D data set, there are 3 options at the upper right side of the screen under **3D**.

- **New** – Returns to the 3D Acquisition window so you can acquire a new data set. (This option is only available when 3D is turned on – not if you are just viewing a 3D data set from the patient archiving system.)
- **Close** – Closes the 3D viewer.
- **Save** – Updates the 3D volume document in the patient archiving system to include saved User Views, measurements and the result of sculpting.

Changing the View

When a volume is displayed, a list of all the available 3D views appears on the upper left side of the screen, under **3D View**. The current view is indicated by a little green light. To change the view, click the one you want.

NOTE: *Scanning is frozen when any view of the 3D volume is displayed.*

Enhancing a 3D View

When a 3D view is displayed, you can use various options under **Settings** on the left side of the screen to enhance the appearance of the 3D volume and make it easier to see the structures you are interested in.

- **Brightness**
- **Contrast**
- **Hue** – Click this to open a window where you can select a hue (color) to color the gray scale part of the volume.
- **Zoom** – Initial zoom is 100%. (**Zoom** is located above Settings on the left side of the screen.)

Presets

After you have set **Brightness**, **Contrast**, **Hue** and **Zoom**, and any Render settings, you can save your settings as a **Preset** on the right side of the screen.

Preset Options	
New	Name the current settings to have them saved as a named preset. You are prompted for a name.
Update	Click this if you want to update the current preset to include new settings.
Del	Deletes the preset that is currently selected.
(Preset Name)	If you have defined any presets, their names appear under New, Update, Del.
Default	Returns to the default preset settings.

Table 20-3. .Options under Presets.

3D Layout Options

When you view the acquired volume, you can change the layout of the screen using the following options under **Layout** on the right side of the screen.

- **Orientation** – Turns the orientation marker on and off. The orientation marker is positioned on the first frame in the scan.
- **Wire Frame** – Shows or hides the wire frame on the volume.
- **Patient ID** – Shows or hides the patient name and ID at the top of the screen.
- **Measure** (only in Cube view) – Shows or hides the measurement lines or boundaries on the volume, the **Measurement** menu (on the right side of the screen), and **Measurement** results (on the left side of the screen).

Manipulating the Volume

You can use the trackball and the [ ] key to manipulate the volume in various ways. The form of the cursor is different, depending on what you are doing.

Rotating

To rotate a volume in any direction:

1. Point outside the volume.

   The cursor looks like this:
2. Hold the [ ] key down while you drag the cursor and rotate the volume.

You can also rotate the intersecting planes view in the 4-Up and 6-Up views.

Moving a Plane In and Out of the Volume

You can move a selected plane in and out of the volume to “slice” the volume so that a plane inside the original volume is displayed as a face of the transformed volume. This new face is called a “cut plane”. The cut plane can be parallel to a one of the original faces of the volume or at an angle (tilted) relative to the axes of the volume.

To slice the volume:

1. Move the cursor onto one of the volume faces.

   The cursor looks like this:
2. Hold the [ ] key down while you drag the cursor to move the plane through the volume until the cut face you want is visible.
3. To restore parts of the volume that you have sliced away, drag the cut plane back through the volume.

Tilting a Plane

You can tilt a plane to see views that are not parallel to one of the original faces of the volume. (This often creates additional planes.)

To tilt a plane:

1. Click the edge of a plane to select it.

   The cursor looks like this , and the wire frame around the plane becomes red.
2. Hold the [ ] key down while you drag the cursor to tilt the cut plane.

   You can then move the tilted cut plane in and out (slice) as described before.

Moving the Volume

To move the volume:

1. Move the cursor so that it is inside the volume.
2. Hold down the **Shift** key (on the keyboard) and the [ ] key on the control panel.

   The cursor looks like a hand.
3. Drag the volume to the position you want, while holding **Shift** and [ ] down.
4. Click when the volume is where you want it.

Animating the Volume

To make the volume rotate automatically forward and back:

- Click **Play** under **Animate**.

  The volume rotates continuously.

To stop the rotation, click **Animate** again.

Under **Animate** on the right side of the screen, you can click to adjust the following animation parameters:

- **Direction** – **Horizontal** or **Vertical**
- **Speed**
- **Span** – the extent of the rotation

Aligning or Deleting a Face

You can turn the volume so that a particular plane is facing you. You can also delete a cut plane.

If you point at a plane of the volume and press the **+** side of the [**+/-**] key, a popup menu appears. If you click **Delete Face**, the plane disappears. If you click **Align Face**, the volume moves so that the plane is facing you.

Annotating a 3D View

As with 2D images, you can annotate a 3D view with a label or arrow. You cannot use a bodymark.

You can add as many labels or arrows to a 3D view as you want. When you have finished, you can save the annotated image as a view that you name.

Label

To add a label to a 3D view:

1. Click **Label** under **Annotations** on the right side of the screen or press [ABC].
   A writing cursor appears.
2. Move the cursor to where you want the label.
3. Type the label.
4. Click. (You can drag the label to reposition it before you click, but after you click, you cannot edit the label, only delete it.)
   You can add additional labels.
5. When you have added all the labels you want, click **Label** again.
6. A window appears for you to name the view with the annotation. You can update the current view to include the annotation, or you can give it a new name.

Arrow

To add an arrow to a 3D view:

1. Click **Arrow** under **Annotations** on the right side of the screen or press [**F10**].
   The cursor appears on the 3D volume with an arrow.
2. Press [**+/-**] to change the orientation of the arrow.
   The tail of the arrow moves in a clockwise direction with each press.
3. Drag the arrow to where you want it and click.
   An arrow is placed on the image.
4. You can add another arrow.
5. When you have added all the arrows you want, click **Arrow** again.
6. A window appears for you to name the view with the annotation. You can update the current view to include the annotation, or you can give it a new name.

   NOTE: *After you have positioned an annotation on the image and clicked, you cannot edit the annotation or move it. You can only delete it. To delete an annotation, click* **Undo**. *The most recent annotation is deleted. You can click*

Undo *several times to remove more than one annotation.* **Redo** *restores the annotation that was just deleted. You can also click* **Clear All** *to remove them all. (***Redo** *will not restore annotations that were deleted with* **Clear All***.)*

User Views

After you enhance the 3D view and annotate it, you can save it as a User View. Settings for volume rotation and slicing, zoom level and annotations are saved in a User View. A User View is specific to a 3D volume.

User Views	
New	Name the current settings to have them saved as a named user view. You are prompted for a name.
Update	Click this if you want to update the current user view to include new settings or annotations.
Del	Deletes the user view that is currently selected.
(User View Name)	If you have defined any views, their names appear under New, Update, Del.

Table 20-4. .Options under User Views.

Cube View

This is a texture-mapped representation of the volume. It is the default view.

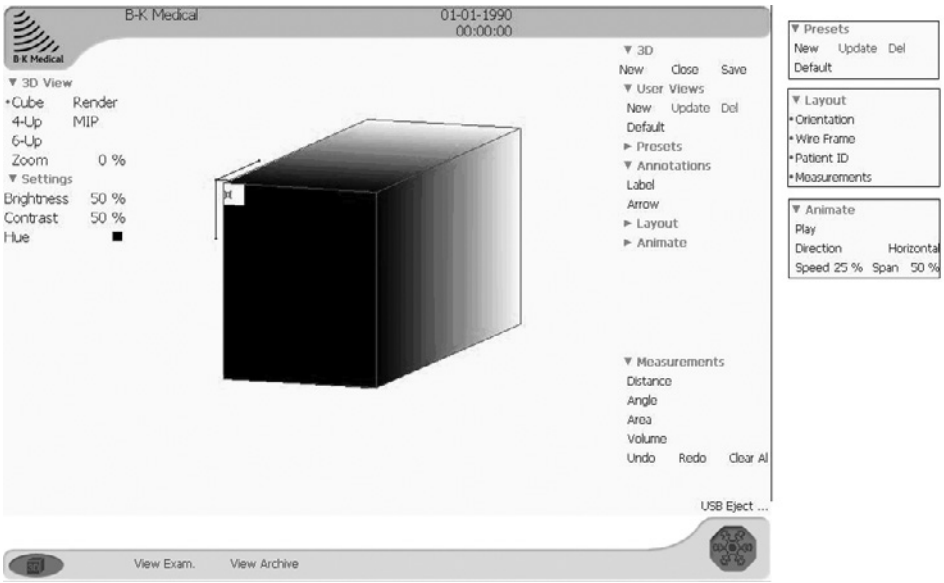


Figure 20-14. The 3D Cube View window.

Making Measurements in a Cube View

In a Cube view, you can measure the length, area and volume of a pathology, if you have used a computer-controlled positioning device to acquire the data set. (You cannot make accurate measurements on data sets acquired using untracked freehand. See the warning on page 293.)

> **NOTE:** *Making measurements on a 3D cube is not the same as making measurements on a 2D image, as described in Chapter 5, "Making Measurements". After you have clicked to position a point to make a 3D measurement, you cannot move the point. You can only complete the measurement (if it requires more points) and then delete the measurement and make a new one.*

To make a 3D measurement:

1. Click the type of measurement you want under **Measurements** on the right side of the screen.
2. Click to position the points of the measurement. See Table 20-5.

   When you click (or double-click, in the case of a polygon) the final point for the measurement, a number appears next to the lines you have drawn. The number is used to label the measurement results.

   The results appear under **Measurements** on the left side of the screen.

Measurement Type	What to Do	Result
Distance	Click to position 2 points. A line connects them.	Distance between the points.
Angle	Click to position 3 points. Two intersecting lines appear.	Angle between the lines.
Area	Click points on the perimeter of the area. A polygon appears. The number of sides in the polygon increases with each click. When you have come to the last point, *double-click* to indicate that it is the final point in the polygon. You must click the points in order so that the polygon does not intersect itself – see note below.	Area of the polygon.
Volume	See instructions on page 306.	Volume calculated from polygons drawn on slices of the volume.

Table 20-5. Measurements on a 3D data set.

Polygon measure-ments

NOTE: *You must click the points in order around the polygon perimeter. You cannot move a point once you have positioned it. If you backtrack, the polygon will intersect itself. If this happens, or if you have made another mistake in drawing the polygon, you must delete the entire measurement (click* **Undo** *on the right of the screen under* **Measurements)** *and start over. If you are in the middle of a volume measurement, the entire volume measurement is deleted, not just the current polygon.*

Deleting Measurements

To delete a measurement:

- Click **Undo** under **Measurements** on the right side of the screen.

  The most recent measurement is deleted.

You can click **Undo** several times to remove more than one measurement.

To restore the measurement that was just deleted:

- Click **Redo** under **Measurements** on the right side of the screen.

To remove all measurements:

- Click **Clear All** under Measurements on the right side of the screen.

  (**Redo** will not restore measurements that were deleted with **Clear All**.)

Measuring Volumes

You measure a volume by drawing polygons around the area of interest on slices taken throughout the Cube. The method for drawing polygons is not the same as for 2D images.

To make a volume measurement on a 3D Cube:

1. Click **Volume** under **Measurements** on the right side of the screen.
2. Click **Step Size** and set the distance between slices of the Cube that will be used for the volume measurements. This does not have to be the same as the step size used for acquisition. (The default step size is 5 mm.)
3. Draw a polygon around the area of interest by clicking points on the perimeter. When you have come to the last point, *double-click* to indicate that it is the final point in the polygon. See note above about clicking the points in order.
4. Click **Next** to move through the volume by the chosen step size.
5. Outline the area of interest in the new slice.
6. Repeat steps 3, 4, and 5 for each slice until the area of interest is no longer visible (the volume measurement is completed).

   The system updates the accumulated volume (in cm^3) as each polygon is completed.
7. Click **Volume** again.

NOTE: *The scanning accuracy in acquired and reconstructed planes is: Distance: ±6% and Area/Volume: ±6%.*

WARNING Measurements obtained with the 3D system and used in diagnosis must be carefully and thoughtfully performed to ensure accurate quantitative assessment. Before you perform a calculation, make sure that all necessary calibrations and measurements are made.

If you suspect that the 3D system's calibration is inaccurate (that is, the measurements are not as expected), contact your local B-K Medical service representative to check and confirm the system's proper operation.

Render View

Rendering dramatically improves 3D visualization. It is useful for looking in detail at soft tissues such as fistulas and abscess cavities. In this view, for gray scale volumes only, you can use sculpting tools to remove obstructing portions of the volume so you can better see the areas of interest. See page 308.

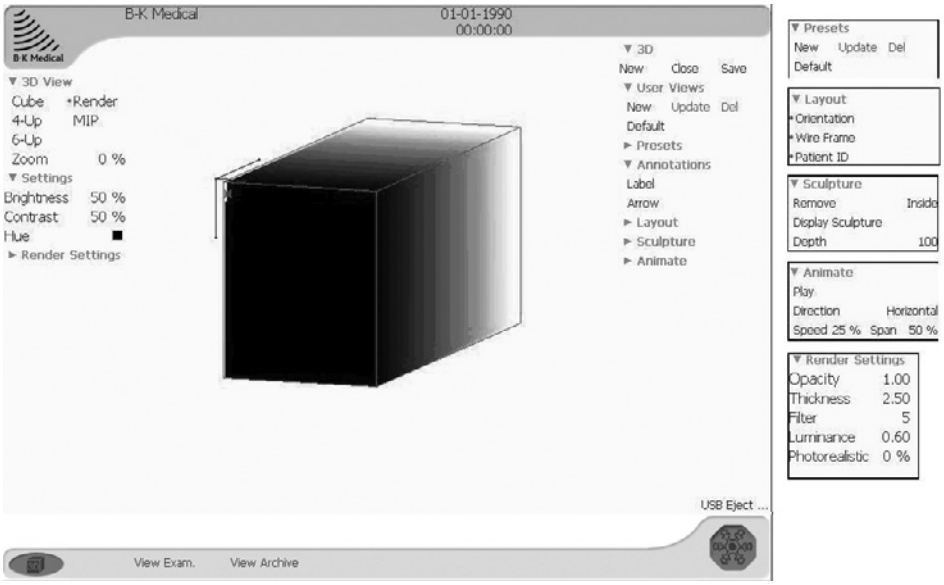


Figure 20-15. The 3D Render View.

Render Settings

You can change the way a Render view looks by adjusting the settings under **Render Settings** on the left side of the screen (see Fig 20-15):

- **Opacity** – Specifies the transparency of a structure.
- **Thickness** – Determines how far you can look into the volume.
- **Filter** – Sets a threshold so that pixels that are not as bright as the threshold are not displayed.
- **Luminance** – Controls the brightness of structures within the volume. Moving the slider to the left increases brightness.
- **Photorealistic** – Adjusts the photorealistic parameter used in the rendering. This can only be used on gray scale volumes.

Sculpting Tools

Sculpting tools let you remove unwanted data from a Render view. Sculpting tools can only be used on gray scale volumes – when there is no color in the volume.

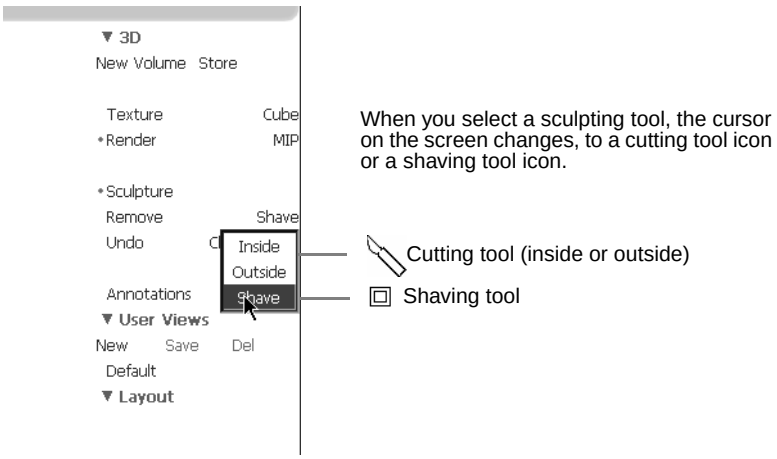
There are two sculpting tools:

- the cutting tool (which you can use to cut away the outside of the volume or to cut a hole inside the volume)
- the shaving tool

To use the sculpting tools:

1 Click **Remove** under **Sculpture** on the right side of the screen.

2 Click to select **Inside**, **Outside** or **Shave**.



3 If you select **Inside**, you can adjust how deep you want to cut. Click **Depth** under **Sculpture** and move the slider to adjust the percentage that is removed when you move the cutting tool.

4 Use the different tools as described below.

5 To turn off the sculpting tools, click **Remove** under **Sculpture**.

To use the cutting tool (inside):

1 Click on one plane of the volume.
2 Hold down [ ] while you drag the to draw a closed curve on the volume plane.
3 Release [ ] when you are finished.
If you have selected 100% **Depth**, a hole appears extending through the volume.

To use the cutting tool (outside):

1 Click on one plane of the volume.
2 Hold down [ ] while you drag the to draw a closed curve on the volume plane.
3 Release [ ] when you are finished.
The area outside the curve disappears.

To use the shaving tool:

1 Click on one plane of the volume.
2 Hold down [ ] while you move the cursor over the area to be shaved.
The longer you hold [ ] down, the more surface is removed.
3 Release [ ] when you are finished.

Displaying Sculpture Results

You can toggle between a view showing the result of sculpting and the unsculpted view. Click **Display Sculpture** under **Sculpture** on the right side of the screen.

MIP View

Maximum Intensity Projection (MIP) emphasizes the pixels with the highest intensity in the volume. If the highest intensities are mapped to the highest blood flow velocities, this mode accentuates and reveals the peak velocity regions of a volume. It is useful for

- looking at maximum flow jets
- visualizing skeletal structures beneath tissue
- looking at vascularization

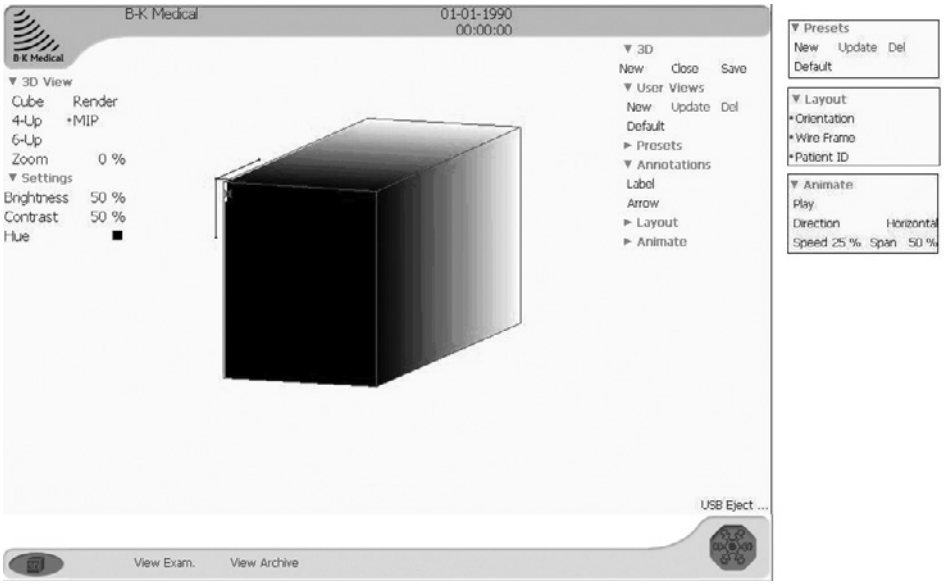


Figure 20-16. The MIP View window.

Transparency View

Transparency rendering (which is only possible when you have acquired the 3D scan using Color or Power mode) lets you adjust the relative transparencies of the color and the gray scale parts of the volume. This can allow hidden features to become visible.

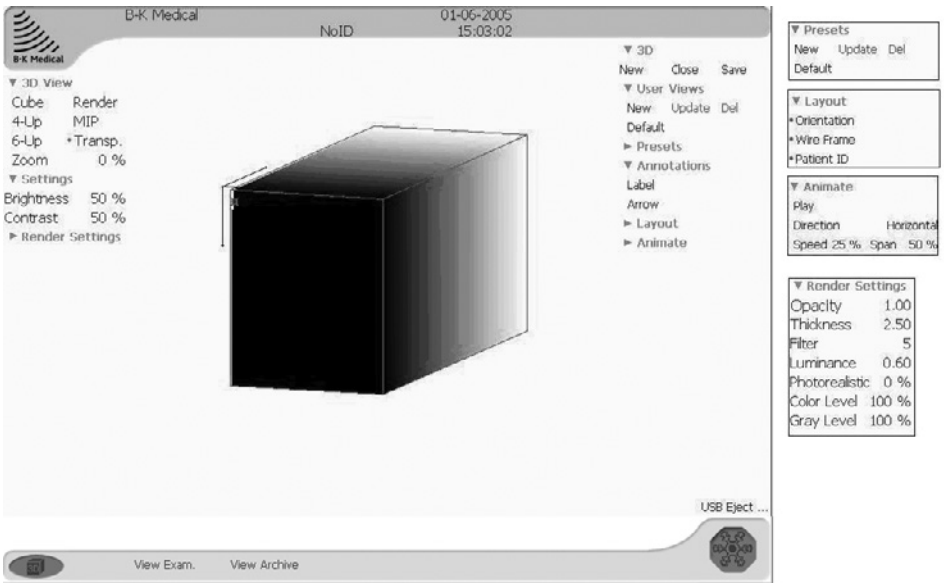


Figure 20-17. The 3D Transparency View window.

Render Settings

You can change the way a Transparency view looks by adjusting the settings under **Render Settings** on the left side of the screen (see Fig 20-17). In addition to the Render Settings available for a Render view, there are 2 Render Settings that apply only to a Transparency view.

- **Opacity** – Specifies the transparency of a structure.
- **Thickness** – Determines how far you can look into the volume.
- **Filter** – Sets a threshold so that pixels that are not as bright as the threshold are not displayed.
- **Luminance** – Controls the brightness of structures within the volume. Moving the slider to the left increases brightness.
- **Photorealistic** – Adjusts the photorealistic parameter used in the rendering. This can only be used on gray scale volumes.
- **Color Level** – Moving the slider to the left makes the color information more transparent.
- **Gray Level** – Moving the slider to the left makes the gray scale information more transparent.

4-Up View

This view has three orthogonal plane views and a view showing the positions of these intersecting planes within the volume. The planes can be moved by adjusting them in the intersecting view.

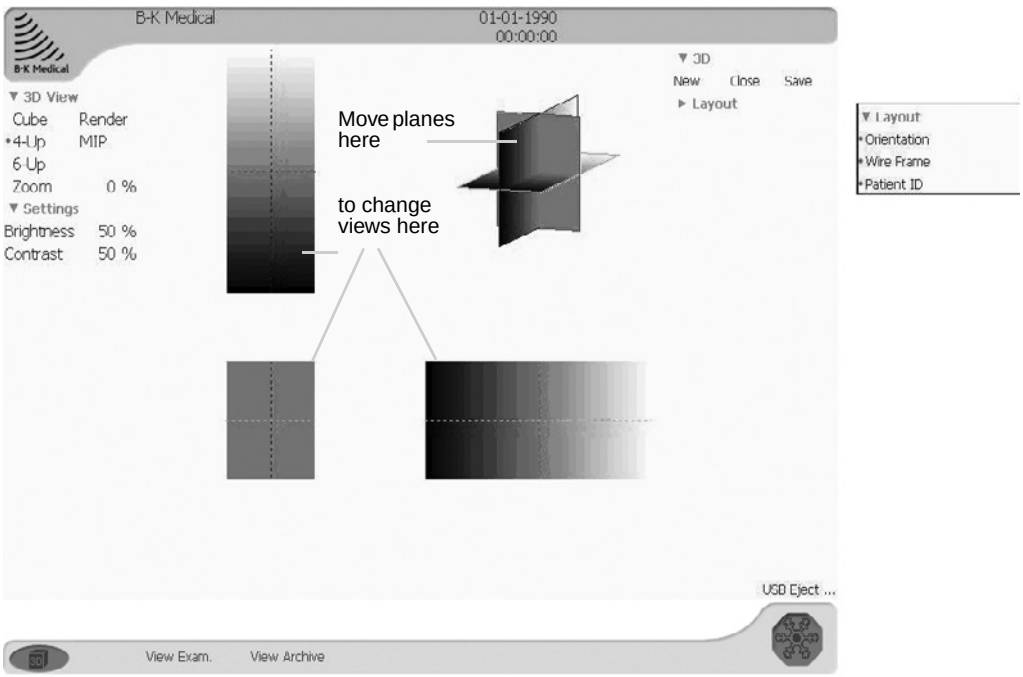


Figure 20-18. The 3D 4-Up View window.

6-Up View

In addition to the views in the 4-Up view, this view contains a Cube view and a sixth view, which is the view most recently displayed (MIP, Render, Transparency or Cube).

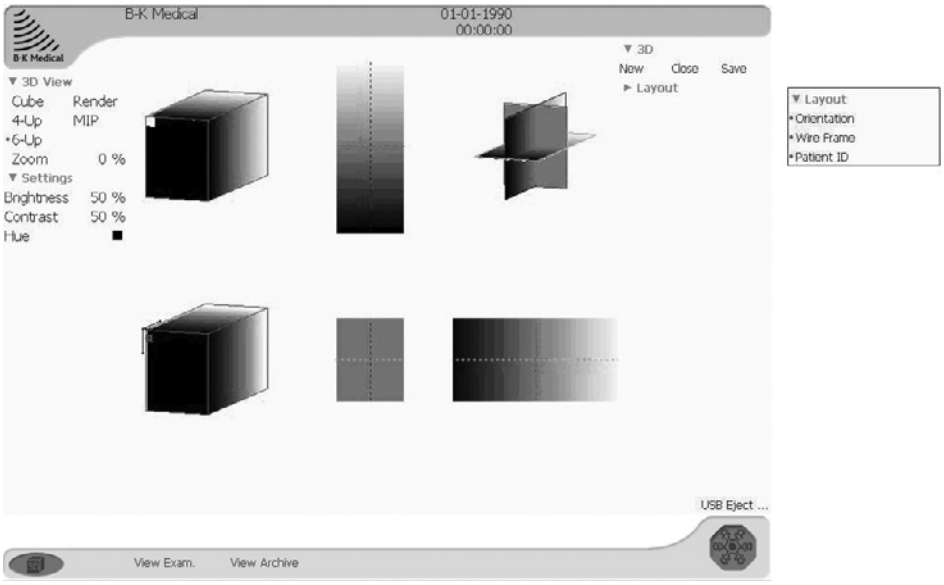


Figure 20-19. The 3D 6-Up View window.

Part 6: Appendixes

Appendix A
Glossary

This glossary contains explanations of terms and abbreviations used in the user guide.

Term	Explanation
A/B	PS/ED
AC	Abdominal circumference.
AD	Abdominal diameter.
AFD	Amniotic fluid distance.
AFI	Amniotic fluid index.
ALARA	As Low As Reasonably Achievable (see page 28).
aliasing	Detection of a false flow in the opposite direction from the real flow. This can occur when the PRF used for the Doppler signal detection is not high enough compared to the flow speed. The problem only exists with pulsed wave Doppler detection.
Ao	Aorta.
AOD	Aortic root diameter.
APD	Abdominal anteroposterior diameter.
array transducer	A transducer that consists of a set of transducer elements, each capable of transmitting and receiving ultrasound.
ATD	Abdominal transverse diameter.
AVD	Aortic valve diameter.
B/A	ED/PS
bodymark	A small drawing positioned on the scanned image to help identify it in documentation. See page 78.
BPD	Biparietal diameter.
catalog	A list of available items, as in a bodymark catalog or label catalog.
CFM	Color flow mapping. See Color mode.

Term	Explanation
CI	Cephalic index. BPD/OFD.
cine	A function that lets you review a series of previously scanned images.
color box	A box drawn on the scanned image that specifies the region of the B-mode image for which color-coded flow information is available in Color mode.
color Doppler	See Color mode.
Color mode (CFM)	Color-Flow Mapping (CFM). Real-time signal that represents the speed of flowing material in each sample volume within the Color mode scan area. The Color mode signal is in principle independent of the amount of flowing material. The Color mode is normally superimposed on a B-mode image that shows the anatomical surroundings. Flow directions towards and away from the transducer are represented as different colors in Color mode (e.g. towards = red, away = blue). The Color mode signal (flow speed) is represented by different values in the color mapping (relative measure) for each sample volume in Color mode. No color means either: • No flow in the sample volume (very low flow speed) or • Amount of reflection from flowing material (which might have a high flow speed) is below threshold set by the Color mode gain. The Color mode signal (flow speed) is dependent on the angle of the ultrasound beam relative to the flow direction.
combination mode	Simultaneous scanning in more than one mode, for example, B+Color or B+Color+Doppler.
control panel	The part of the Pro Focus keyboard panel that contains the special scanner control keys. For a description, see “The Control Panel” on page 52.
CRL	Crown rump length.
Doppler mode	(Spectral) Doppler mode. This mode displays information about the spectrum of flow velocities as a function of time. It is sometimes called FFT (Fast Fourier Transform) because the information is presented as a frequency spectrum indicating velocity components.
duplex	Simultaneous scanning in 2 modes. See combination mode.
ED	End diastolic velocity.

Term	Explanation
EDC	Expected date of confinement.
EMC	Electromagnetic compatibility.
ES	End systole. See page 253.
ESD	Electrostatic discharge.
ETO	Ethylene oxide gas. Used for disinfecting. See page 204.
FBL	Fibula length.
FD	Follicle diameter.
FFT	Fast Fourier Transform. FFT is a method of calculating the Fourier Transform (frequency spectrum) of something that is moving as a function of time. It is used to calculate the spectrum displayed in Doppler mode imaging.
FL	Femur length.
FOI	Field of interest. The area within the B-mode image where resolution and focus are maximal.
FW	Fetal weight.
GA	Gestational age.
GAc	Gestational age (clinical).
GAu	Gestational age (by ultrasound).
graphical control	An on-screen control that is graphical, unlike a softkey. Graphical controls are located in the image area of the screen. Examples are the zoom box, color box, focus indicator, Doppler gate.
GS	Gestational sac diameter.
HC	Head circumference.
HIPAA	Health Insurance Portability and Accountability Act of 1996. American law that sets rules for how patient accounts, billing and medical records must be handled.
image bar	Series of small images below the main scanning image. Each image represents a document such as a 2D image, video clip or report.
image review	See cine.
IOP	Intraoperative – during a surgical operation.
keyboard panel	The part of the Pro Focus 2202 Ultrasound Scanner that contains the keyboard and the control panel.

Term	Explanation
label	Text positioned on the scanned image to label it. See page 75.
LC	Length of cycle.
LICA	Left internal carotid artery.
LMP	Last menstrual period. LMP is the abbreviation on reports. The field in the patient window for this information is Last Menst. Date.
MAD	Mean abdominal diameter ((ATD+APD)/2).
MD	Minimum diastole. See page 253.
MIP	Maximum Intensity Projection (3D imaging). See page 309.
OB	Obstetrics.
OFD	Occipitofrontal diameter.
PACS	Picture Archiving and Communications System (DICOM).
PCU	Palm Control Unit.
PE	Previous examination.
PED	Previous examination date.
perioperative	Around the time of a surgical operation.
phased array	A technique to control the scan area by using time delays on an array transducer.
PI	Pulsatility index (see page 256).
PL	Foot (pes) length.
planimetry	Measuring the surface area and perimeter of an object by tracing its boundaries.
Power Doppler	A real-time signal representing the size of reflection from material that is flowing. The Power mode is normally super-imposed on a B-mode image that shows the anatomical information. Power mode is in principle independent of the speed of the flowing material.
power supply cord	The cord that connects the base power unit to the wall outlet.
PRF	Pulse repetition frequency.
Pro Package	An application package containing Diagnostic Setups, measuring tools and calculation formulas.
PS	Peak systole. See page 253.

Term	Explanation
PS	Peak systolic velocity.
PSA	Prostate-specific antigen.
PSAD	PSA density: PSA divided by prostate volume.
pulse repetition frequency	The rate at which pulses of ultrasound waves are transmitted and received in PW (pulsed-wave) Doppler scanning. See “Adjusting the Thermal Index Limit” on page 153.
PW Doppler	Pulsed wave Doppler. A type of (spectral) Doppler scanning. See “Adjusting the Thermal Index Limit” on page 153.
RCCA	Right common carotid artery.
RECA	Right external carotid artery.
RI	Resistance Index (see page 256).
RICA	Right internal carotid artery.
ROI	Region of interest.
spectral Doppler	See Doppler mode.
SS	Start systole. See page 253.
standby switch	The switch on the front of the scanner body used for turning the scanner on and off each day.
TAM	Time Average Mean (see page 254).
TBL	Tibia length.
TEH	True echo harmonics. B-K Medical’s trademarked term for its tissue harmonic imaging system.
TGC	Time gain control.
THAP	Thorax anteroposterior diameter.
TI	Thermal index. The estimated rise in tissue temperature (in °C) caused by the power emitted by the transducer.
TIB	Thermal index in bone at focal point.
TIC	Thermal index, cranial – bone at surface.
TIS	Thermal index in soft tissue.
trackball keys	The 2 [ ] keys and the [**+/-**] key. See “The Trackball and Trackball Keys” on page 53.
triplex	Simultaneous scanning in 3 modes. See combination mode.

Term	Explanation
TT	Thorax transverse diameter.
UDF	Universal Disk Format.
VL	Vertebrae length.
voxel	A three-dimensional pixel. A **vo**lume pi**xel**.
wall filter	A wall filter is used to eliminate low-frequency artifacts in Color, Power and Doppler modes. It cuts off all frequencies below its cutoff frequency. See page 140.

Appendix B
Technical Guide

This chapter contains information about the electrical requirements and operating conditions for the scanner as well as important information about attaching other equipment and so on. Before you turn on the scanner, make sure that the installation has been approved by a qualified service technician or by hospital safety personnel. See Safety Precautions in Chapter 1, “General and Safety Information”.

Operating Environment

The Pro Focus can be operated safely within the following operating condition limits:

Condition	Limits
Ambient operating temperature	10°C to 40°C (50°F to 104°F)
Humidity	max. 85% RH non-condensing
Atmospheric pressure	between 700 hPa and 1060 hPa

Table B-1. Operating condition limits.

WARNING Follow the guidelines in EN 60601-1-1[1] when you connect the scanner to other equipment. See “General Safety Precautions” on page 21.

Explosion hazard

WARNING During use, the scanner must be at least 25 cm (10 in) from the patient to minimize the risk of igniting explosive gases.

The scanner is not intended for use in potentially explosive environments and should be kept well away from flammable gases and liquids. It should not be used in oxygen-enriched atmospheres. Avoid excessive heat, dust and direct sunlight.

The Rear of the Scanner

The rear of the scanner body (see Fig B-1 and Fig B-2) contains a large number of connectors for connecting different equipment.

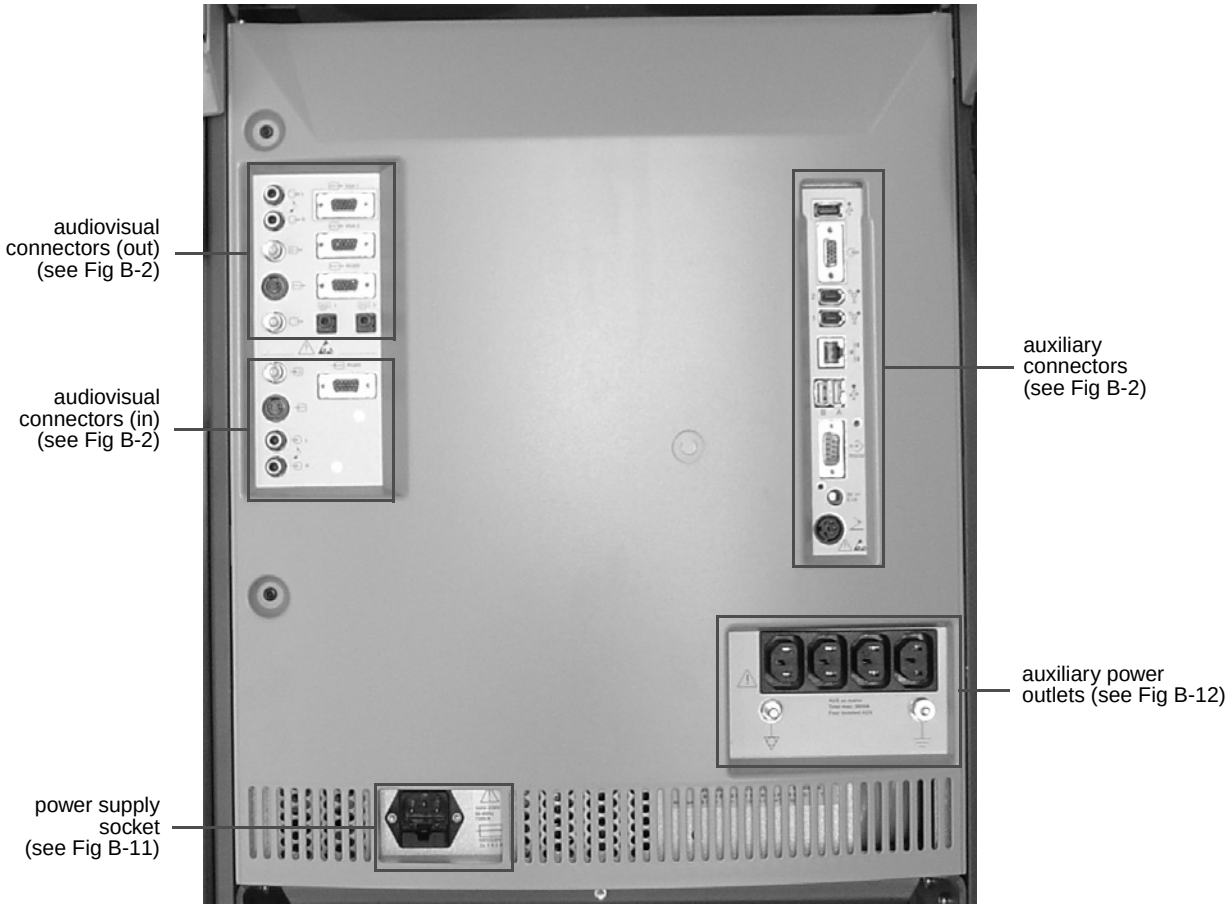

audiovisual connectors (out) (see Fig B-2)
audiovisual connectors (in) (see Fig B-2)
power supply socket (see Fig B-11)
auxiliary connectors (see Fig B-2)
auxiliary power outlets (see Fig B-12)

Figure B-1. The scanner's rear panel.

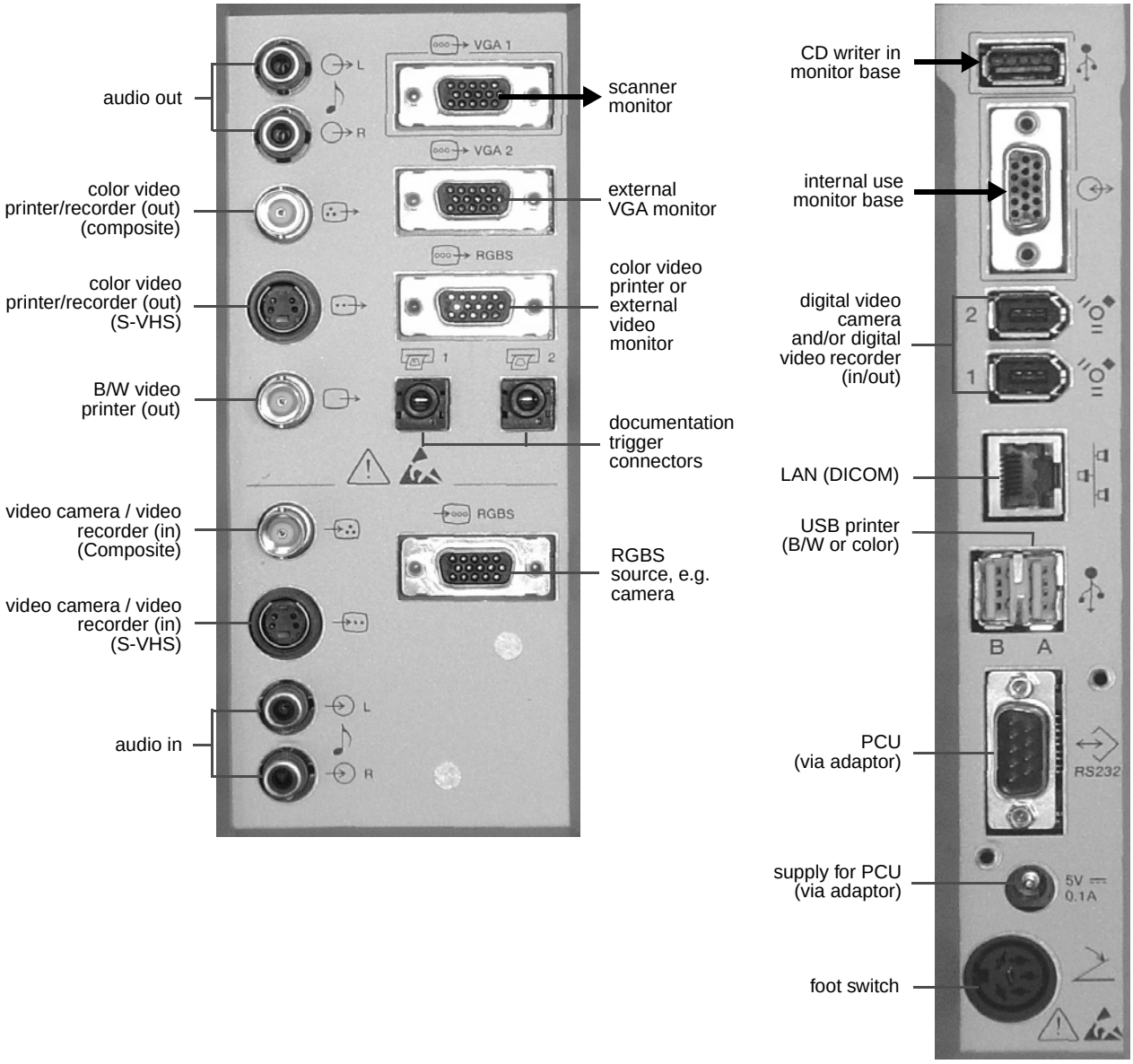


Figure B-2. The peripheral connectors on the rear of the scanner.

Bold arrows indicate connections installed at the factory. Do not change these connections.

Caution: If Fig B-2 does not indicate what to use a particular connector for, don't use it. Some connectors will be used for future options.

Cables Types and Lengths

Table B-2 specifies the cables that were used to test the electromagnetic compatibility (EMC) of the scanner. EMC data for all transducers used with this scanner are on a CD (BZ2100) that accompanies this user guide. The CD also contains a list of accessories used in testing for EMC compliance.

To fulfill EMC requirements, do not attach cables to the scanner unless they are the same type as listed in the table and do not exceed the maximum length given in the table.

Symbol	Connector	Part number	Type and Maximum Length
	Color Composite Out	AO0142	Shielded, 3 m
	Color Composite In	AO0142	Shielded, 3 m
	B/W Composite Out	AO0142	Shielded, 3 m
	S-VHS In	EL4003 (included in EU4009)	Shielded, 2 m
	S-VHS Out	EL4003 (included in EU4009)	Shielded, 2 m
	Audio In	EL4017 (included in EU4009)	Shielded, 2 m
	Audio Out	EL4017 (included in EU4009)	Shielded, 2 m
	VGA 2 Out	AO1382	Shielded, 2 m
	RGBS Out	AO1382	Shielded, 2m
	RGBS In	AO1382	Shielded, 2m
	Documentation Trigger 1	EL4020	Shielded, 1m
	Documentation Trigger 2	EL4020	Shielded, 1m
	FireWire™ 1	-	Shielded, 2m
	FireWire™ 2	-	Shielded, 2m
	DICOM	Included in DP0925	Shielded, 3 m
	USB A	-	Shielded, 5 m
	USB B	-	Shielded, 5 m
	RS232	PCU adaptor UA1271	-
	ECG wire (on front panel)	AO0366	Shielded, 3.5 m

Table B-2. List of cables used in testing for EMC compliance.

Monitors

The Pro Focus monitor is connected to the **VGA1** connector. The power to the monitor comes from one of the auxiliary power outlets. See page 332. You can use the **VGA2** connector for an external VGA monitor.

Audio Input and Output

An audio Doppler signal is available from the (**L** and **R**) connectors.

Speakers

The speakers are connected to an internal amplifier (built into the monitor base) and connected to the connector at the top right of the rear panel via a multi cable.

Recording

To record an audio signal, connect the connectors to a video recorder. To play a recorded signal back through the scanner speakers, connect the video recorder output to the connectors.

Documentation Accessories

The Pro Focus comes with a digital B/W printer (EQ4098) which should be connected to the port **A**.

If you install other documentation accessories, always follow the installation and verification instructions in the user guide that accompanies them. See “Connecting Other Equipment” on page 25.

Always use the cables specified in Appendix C, “Specifications”.

PAL/NTSC

The format for the video output that is sent to a video printer or video recorder can be either PAL or NTSC.

To set the format for video output from the scanner:

1. Make sure that the PAL/NTSC switch on the rear of the printer is set to the appropriate format.
2. Open the **General Setup** window (see page 171).
3. Select the video output setting you want, and close the window.

Video Documentation Equipment

Table B-3 gives an overview of video documentation connections. See also Table B-2.

Equipment	Signal type	Connector	Comments
Video printer, B/W	Composite Out		
Video printer, Color	RGBS Out	RGBS	The R, G, and B signal levels are 0.7Vpp/75Ω. The S (Sync.) signal level is TTL.
Video printer, Color	Composite Out		
Video recorder	Composite Out		
Video recorder	Composite In		For playback

Equipment	Signal type	Connector	Comments
Video recorder	S-VHS Out		
Video recorder	S-VHS In		For playback
Video monitor, B/W	Composite Out		
Video monitor, Color	RGBS Out	RGBS	Only one piece of external equipment can be connected to the RGBS connector.
Video camera	RGBS In	RGBS	
Video camera	Composite In		
Video camera	S-VHS In		
Digital video camera	Digital video In/Out	1 or 2	
Digital video recorder	Digital video In/Out	1 or 2	

Table B-3. Overview of video documentation connections.

Documentation Trigger Connectors

In order to use the foot switch or [ ] key to print the image on the screen, connect 1 or 2 to the trigger input of a video printer. For information about assigning a key or foot-switch pedal to 1 or 2, see “User-Defined Keys” on page 169.

USB Devices

The CD writer built into the monitor base is connected to the port at the top right of the rear panel. For information about saving images on a CD, see Chapter 6, “Documentation”.

port **A** is reserved for use with USB printers (black and white or color).

Images can be saved on a USB storage device (such as a USB flash drive) through the USB port on the bottom left hand side of the monitor base. For information about saving images, see Chapter 6, “Documentation”.

Connecting to a Surgical Rack

Using the optional Rack Docking System™, you can connect the scanner to a surgical rack quickly, with just one connector. Then monitors in the operating room can easily be used to view the ultrasound image. This is especially advantageous if you are using the optional Picture-in-Picture (PiP) functionality. For further details on PiP, See “The Video Window and Picture in Picture (PiP)” on page 82.

The scanner can easily be disconnected from the rack and used in another operating room.

The Rack Docking System consists of the following parts:

- Docking Cable UA2210
- Docking Box UA2211 (one for each surgical rack)
- Holder for docking cable and PCU UA2212

WARNING When you connect other equipment to the scanner, thus creating a medical system, always follow the guidelines given in EN60601-1-1 [1]. If in doubt, contact your local B-K Medical representative.

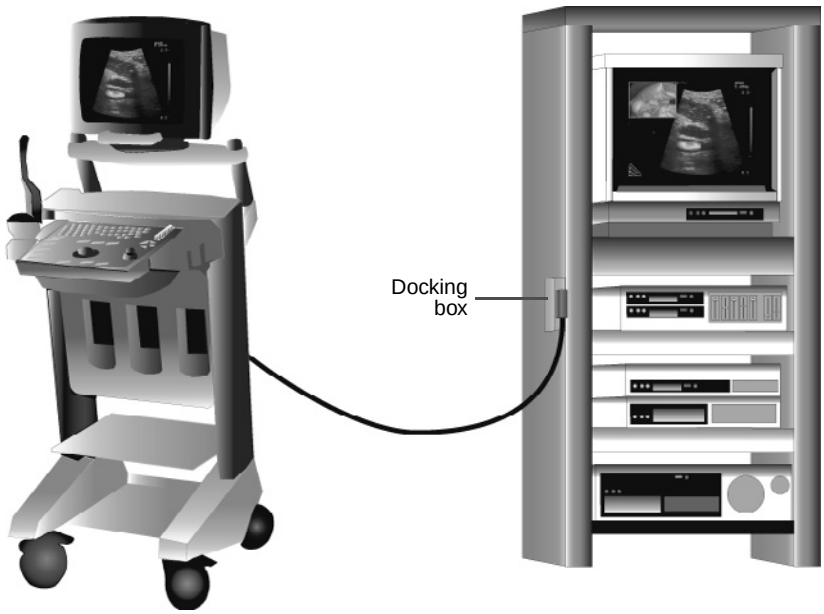


Figure B-3. Scanner connected to the Rack Docking System™.

The docking cable connects the scanner to the docking box, which is mounted on the surgical rack.

Caution: When the docking cable is not connected to the docking box, the “blind connector” must be firmly in place on the docking box. Otherwise the surgical rack will not operate correctly when the scanner is not attached. See page 329 for instructions about attaching the “blind connector.”

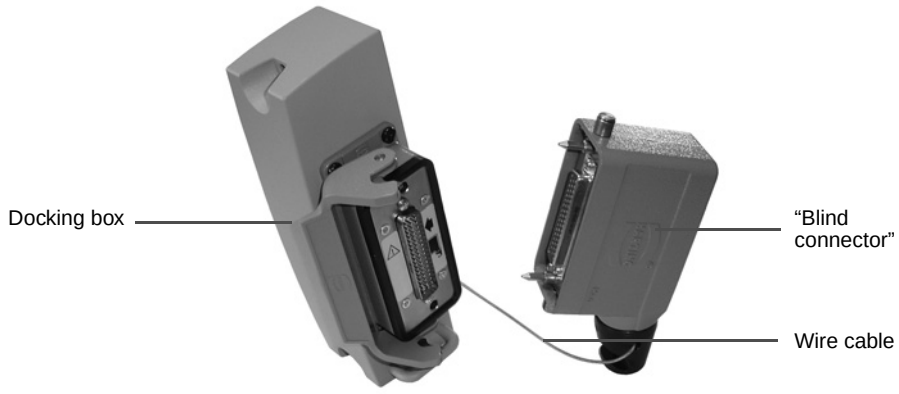


Figure B-4. The 'blind connector'.

Docking Cable

At one end of the docking cable are a number of scanner connectors that connect to the rear of the scanner. The other end has a docking box connector that plugs into the front of the docking box on the surgical rack. See Fig B-5.

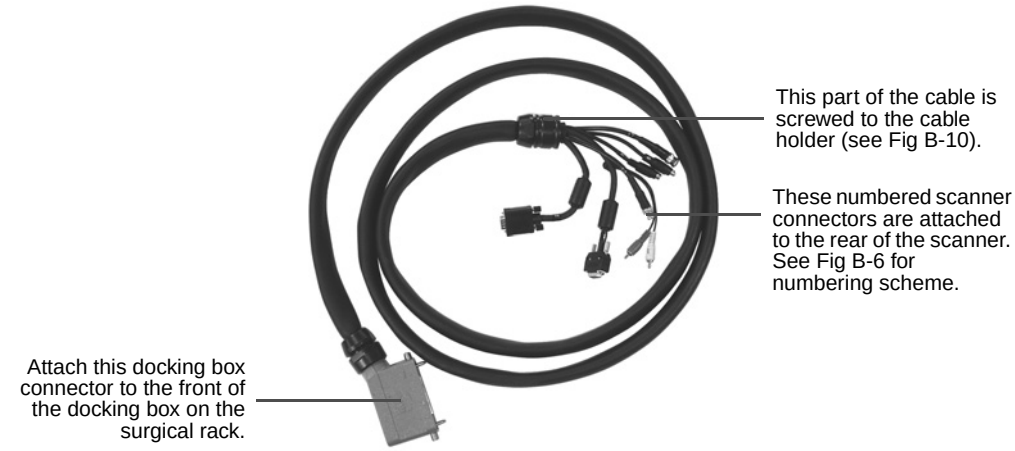

This part of the cable is screwed to the cable holder (see Fig B-10).
These numbered scanner connectors are attached to the rear of the scanner. See Fig B-6 for numbering scheme.
Attach this docking box connector to the front of the docking box on the surgical rack.

Figure B-5. The docking cable with connectors.

The scanner connectors on the docking cable are numbered. Attach each scanner connector to the connector on the rear of the scanner according to the numbers shown in Fig B-6.

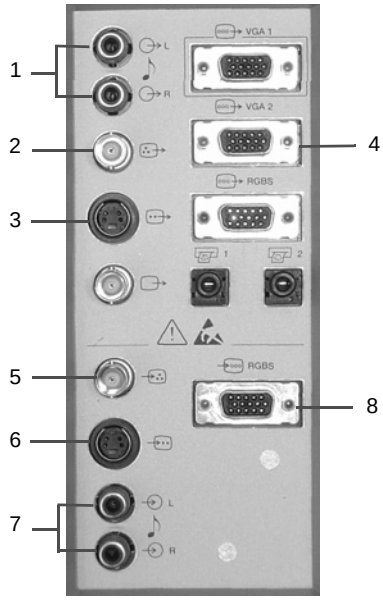


Figure B-6. Numbers showing where on the rear of the scanner to attach the numbered scanner connectors. (Bigger picture of these connectors is in Fig B-2.)

Docking Box

The docking box is screwed onto the side of the surgical rack. The docking cable attaches to the front of the docking box. The back of the docking box is connected to equipment on the surgical rack. The connectors on the back panel of the docking box (Fig B-9) correspond to connectors on the rear of the scanner.

Connections on front

To connect the cable or "blind connector" to the docking box:

1 Press the docking box connector (see Fig B-5) on the cable, or the "blind connector" (attached to the docking box by a wire cable) firmly into the connector on the docking box.

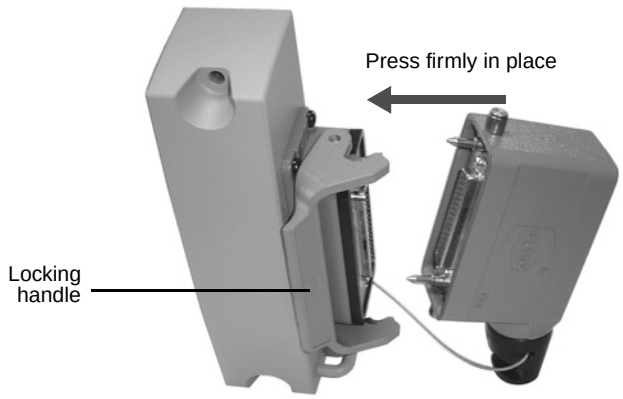


Figure B-7. Attaching the docking cable (or "blind connector") to the docking box.

2 Lift the locking handle to lock the connector firmly in place.

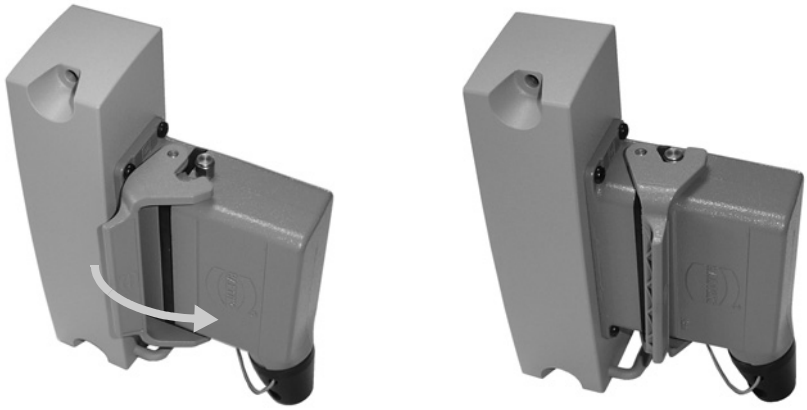


Figure B-8. Locking the connector firmly in place.

Release the locking handle in order to remove the connector from the docking box.

Connections on back

For an explanation of the sockets and their symbols, see “Video Documentation Equipment” on page 325.

Figure B-9. The docking box back panel.

Holder for Docking Cable and PCU

The cable holder (Fig B-10) is attached to the rear of the scanner by 2 metal tabs inserted into small holes on the right side and by 2 screws (M4x8) on the left side. The scanner connector end of the cable is screwed to the cable holder with 2 screws (M3x8).

Attach docking cable scanning connectors here
Cable holder attached to scanner here with 2 screws.
Part of the scanner connector end of the cable is screwed on here.
Holder for PCU
Cable holder

Figure B-10. The holder for docking cable and PCU attached to the rear of the scanner.

When the scanner is not attached to a surgical rack, wind the docking cable around the cable holder.

Foot-Switch Connector

A connector for connecting the optional foot switch (see page 69) is at the bottom of the auxiliary connectors (see Fig B-2 on page 323).

Electrical Connections

Power Supply Cord

The scanner comes with a power supply cord that is specific to your region. The connector (see Fig B-11) is on the lower left side of the rear panel.

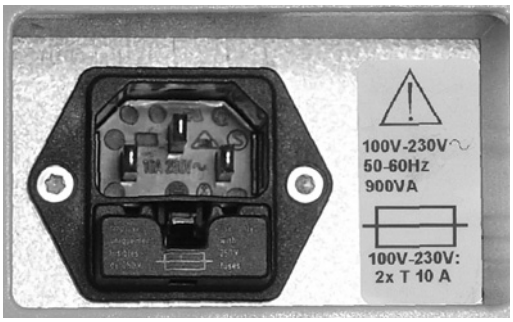


Figure B-11. The connector for the power supply cord.

WARNING Use only the power supply cord that comes with the scanner. Never use extension cords. The increased length of the cord will increase the resistance of the protective ground conductor and may increase the equipment's leakage current beyond an acceptable level.

The power supply cord for the USA has a hospital-grade 3-prong grounded power plug. Contact your local B-K Medical representative if you need a different plug.

WARNING Never try to remove or change the plug on the power supply cord.

Cord Retaining Kit UA2204

The optional cord retaining kit UA2204 is attached to the power supply socket to ensure that the power supply cord cannot be accidentally disconnected from the scanner. The kit consists of two mounting screws and two brackets, each fitting a different type of power plug.

Connecting Other Equipment

For important information about connecting other equipment safely, see “Connecting Other Equipment” on page 25.

WARNING When you connect other equipment that uses the line voltage (such as a video printer, video recorder, endoscopic camera control unit or other documentation device) to the scanner, the connections must follow the guidelines given in EN 60601–1–1 [1]. If in doubt, contact your local B-K Medical representative.

Auxiliary Power Outlets

To minimize leakage currents, plug all other equipment into the isolated auxiliary power outlets on the bottom right of the rear panel. There are 4 auxiliary outlets, as shown in Fig B-12.

WARNING The 4 auxiliary power outlets are still “live” even when the standby switch on the front is turned off. In order to remove voltage from these outlets, you must unplug the power supply cord from the wall outlet.

Figure B-12. Auxiliary power outlets.

The voltage and frequency of these outlets is the same as from the power supply cord. The thermal fuses limit the power that can be drawn from the outlets to a safe level, but the total output from the auxiliary outputs must not exceed 200 VA. (Actually, the total output is limited to 350 VA, but the scanner monitor, using 150 VA, is permanently plugged into one of the outlets. This leaves 200 VA for accessories.)

Additional Protective Ground and Potential Equalization

An additional protective ground can be connected to the ⏚ terminal below the auxiliary power outlets (see Fig B-12).

The potential equalization terminal ⏚ below the auxiliary power outlets (see Fig B-12) is connected to the scanner chassis. It can be connected to corresponding terminals on other equipment to eliminate potential differences. Do NOT use it for additional protective grounding.

Dismantling the Scanner for Transportation

Caution: The front panel and the monitor can be removed to allow easy transportation (see Fig B-13).

Figure B-13. Removing the front panel.

To remove the front panel:

1. Move the front panel to the top position.
2. Unplug and disconnect the front panel from the scanner.
3. Remove the sliding cover.
4. Undo the black screws under each side of the front panel.
5. Press the black release handles and lift the front panel out of the groove.
6. Replace the sliding cover.

To replace the front panel:

1. Remove the sliding cover.
2. Slide the front panel back into the groove.
3. Tighten the black screws.
4. Reconnect to the scanner.

To remove the monitor:

1. Move the monitor base to the top position.
2. Disconnect the monitor from the scanner.
3. Disconnect the internal power supply connector and the USB connector for the circuit in the monitor base.
4. Remove the sliding cover.
5. Loosen the two black screws on the back of the scanner under the monitor.
6. Lift the monitor base carefully out of the groove.

To replace the monitor:

1. Slide the monitor base into the groove.
2. Tighten the black screws.
3. Reconnect to the scanner.

References

[1] EN 60601–1–1:2001 *Medical electrical equipment – Part 1-1: General requirements for safety. Collateral standard: Safety requirements for medical electrical systems.*

Appendix C
Specifications

Scanning Modes

Modes
B-mode
B-mode + M-mode
B-mode + Tissue Harmonic Imaging
B-mode + Contrast Harmonic Imaging
B-mode + Doppler (steerable)
B-mode + Color Flow Mapping (CFM) (steerable)
B-mode + Power Doppler (Directional Power) (steerable)
B-mode + Doppler + CFM (Triplex Mode) (steerable)
B-mode + Doppler + Power Doppler (Triplex Mode) (steerable)
B-mode + CW (continuous wave) Doppler (steerable)

Transducers

Transducer Center Frequency Range	
Single-element transducers	5–10 MHz
360° rotating single-element transducers (option)	5–20 MHz
Linear and convex array transducers	2–15 MHz

Features

Features

- Fully digital
- Tissue Harmonic Imaging
- Split screen (vertical and horizontal)
- Simultaneous live split-screen imaging
- User setups
- Image Review (cine) for up to 600 images depending on scanning mode
- Clip browser
- Fully integrated 3D (option)
- Palm Control Unit (PCU) (option)
- Timer
- Edge enhancement
- Non-linear 2D persist filter

Features	
• Picture-in-Picture (option) • Report function • Copy/Recall system and transducer setup • DICOM networking (optional) • User-defined hard keys • Channels: 1024 element processing capability	• Automatic Mode Adjustment • Matching sliding filters • True Hilbert detection • Post-processing • Adjustable monitor and keyboard • Image Storage: CD, hard disk and USB storage device (option)

Display Characteristics

Monitor	
15" screen. SVGA. 75 Hz	
Image Characteristics	
Ultrasound image	512 x 480 pixels; 256 gray levels plus 256 colors
Graphics overlay	800 x 600 pixels, 32-bit true color
Presentation	images can be mirrored up/down and left/right
Sweep Speed	
2-14 seconds per screen	
Size (zoom)	
1 x 1 cm to 25 x 25 cm in tissue; the number of steps and maximum size depend on the transducer	
Frame Rate	
> 150 Hz (automatically optimized), depending on the transducer	
Preprocessing	
TGC	overall gain, fine gain (TGC)
System dynamic range	> 150 dB
Gray scale conversion	10 scales
Color conversion	6 scales
Doppler conversion	5 scales
Focal Zones	
Up to 25 transmit zones depending on transducer	
Up to 8 transmit zones for composite focus	

Continuous receive focusing
Image Markings
Image scale
Puncture lines
Image Annotations
Alphanumeric
Labels and comments (user-defined libraries)
Adjustable annotation arrow
Bodymarks (user-defined libraries)
Patient and hospital IDs
Real-time clock showing date and time, with battery backup.

Doppler

Doppler	
Pulsed Wave Doppler	
Sample volume size	1–20 mm
Units	cm/s or kHz
Flow inversion	Yes
Flow offset	Yes
Pulse Repetition Frequency (PRF)	1–15 kHz
Wall filter	Digital filter. Cutoff frequency 1–10% of PRF
Detectable speed	0.13 cm/sec–4.6 m/sec at 0°
Display	B/W or color FFT spectra, 256 levels
Frequency resolution	Max 7.8 Hz (PRF=1 kHz)
Time resolution	Max 4 msec
Angle correction	1° steps
Doppler audio output	2 x 1 W
Power Doppler – Directional Power Doppler	
Sample	Max 512 points
Pulse Repetition Frequency	0.2–12 kHz
Wall filter	Digital filter

Doppler (continued)	
Display	Power: 256 colors 6 different color scales
Color Flow Mapping – Variance Color Doppler	
Sample	Max 512 points
Pulse Repetition Frequency	0.2–12 kHz
Wall filter	Digital filter. Cutoff frequency 1–10% of PRF
Detectable speed	0.1 cm/sec–4.3 m/sec at 0°
Display	Velocity: 256 colors Velocity + variance: 128 x 32 colors 6 different color scales
Color Doppler interleave factor	64 lines
Continuous Wave Doppler	
Range	1.3–30 kHz
Wall filter	Digital filter. Cutoff frequency 1–20% of PRF
Detectable speed	0.31 cm/sec–9.2 m/sec at 0°
Steerable Doppler	
Angle	± 20°

Measurements

Measurement Facilities	
Trackball	Point, move and measure
Pro Packages	General, OB/Gyn, Surgery, Urology, Cardiac

Connections

Connection Possibilities	
Transducers	4 active sockets: Linear and convex array (3); Single-element (1) (option)
Number of acoustic channels	Up to 192
External controls	Foot switch, transducer button, optional Palm Control Unit (PCU)

Connection Possibilities (continued)	
Signal output	Audio, stereo line level
	Color composite video (CVBS) Black/white composite video (CVBS)
	S-video (Y/C)
	RGB video
	2 x SVGA, 75 Hz
Image storage	Internal hard disk, CD-RW or USB storage device
Documentation trigger	2 units
Signal input	Audio, stereo line level
	Composite color video (CVBS)
	S-video (Y/C)
	RGB video
Communication	RS232 serial channel
	3 x USB 2.0
	2 x IEEE 1394a FireWire
	10/100 Ethernet
Isolated auxiliary power outlets	100–230 V AC (equal to input voltage), max total output available for use 350 VA
DICOM network (optional)	

Power Supply

Complies with requirements for Class 1 (protective earth) devices of EN/IEC 60601-1 [1].

Power	
Voltage	100–230 V AC
Frequency	50–60 Hz
Power consumption	900 VA total (incl. the 350 VA isolated power outlet)
Automatic circuit breakers	2

Fan Noise

Noise	
Noise during operation	<30dBA

Operating Limits

Environmental Limits	
Operating temperature	+10 to +40°C (+50 to +104 °F)
Storage temperature	–25 to +60°C (–13 to +140°F)
Operating and storage humidity	Max 85% RH non-condensing
Operating pressure	700–1060 hPa (normal atmospheric pressure)

Disinfection

Chemical resistance of console during disinfection	
Wiping with	Sodium hypochlorite up to 2% in water
	Chlorhexidine gluconate 5% in water
	Chlorhexidine 1.5% and cetrimide 15% in water
	Chlorhexidine 0.5% in ethanol 70%
	Glutaraldehyde 2% solution
	Ethanol 70% in water
	Isopropanol 70% in water

Dimensions

Approximate Dimensions	
Height	1410–1500 mm (adjustable)
Width	530 mm
Depth	780 mm
Weight	77 kg (excluding transducers and printer)

Electromagnetic Compatibility

Complies with requirements for Class A devices of EN 60601-1-2 [2].

Accessories

Accessories Included	
BB1279	*Pro Focus 2202 Extended User Guide* (English)*
BB0555	*General Transducer Information* (English)**
QA0228	Trackball adjustment tool
BZ2100	*Technical Data CD*
EQ4098	Digital B/W printer (Sony UP-D895)

* A user guide is available in other languages.
** also available in other languages

Miscellaneous Accessories	
Transducers	For more information about B-K Medical's transducer program, please contact your local sales representative
UA1215	Foot switch
EJ4000	Plug for isolated auxiliary power outlets
UA0610	Scanning gel (5 L)
WQ0739	Scanning gel (290 ml)
DZ9756	Transducer holder inlay
UA2410	Palm Control Unit (PCU)
UA1271	Adaptor for PCU
UA0029	Sterile PCU and cable cover
UA2206	DICOM option (license)
UA2205	Picture-in-Picture (PIP) option (license)
UA2207	3D option (license)
UA2202	3D mover module
UA2202-K	3D mover module kit
UA2210	Docking cable
UA2211	Docking box
UA2212	Holder for docking cable and PCU
UA1302	Endo transducer holder
UA2203	ECG module

Miscellaneous Accessories	
AO0366	ECG electrode cable (included in UA2203)
QA0210	ECG electrodes (box of 50) (included in UA2203)
UA2201	360° mechanical input module (when purchased with scanner)
UA2201-K	360° mechanical input module kit (field upgrade)
DP0889	Paper holder
UA0955	Scanner cover

Documentation Accessories	
EQ4072	Printing paper for EQ4098 (UP-110HG)
EQ4080	Digital recorder (Sony DSR-20MDP)
EQ4081	Video tape DVCAM 60min. (Sony DVM-60EX2)
EQ4099	Digital color printer (Sony UP-D23MD)
EQ4093	Color printing pack UPC-21S (small image size) for Sony UP-D23MD
EQ4094	Color printing pack UPC-21L (large image size) for Sony UP-D23MD
EU4009	Cable set (power and signal cables) for video recorder
SC1624	Shortcut stickers for Pro Focus

Safety

Complies with EN/IEC 60601-1 [1], EN 60601-2-37 [3], UL2601-1 [4] and CSAC22.2 No. 601.1 [5].

Approvals
UL International DEMKO (CB certification)
UL Listed
CUL (UL listing for Canada)
TÜV (Germany) - pending
JMI (Japan) - pending
EU Medical Device Directive 93/42/EEC
Market clearance
FDA

Equipment Manufacturer

B-K Medical
Mileparken 34
DK-2730 Herlev
Denmark

References

[1] EN 60601–1–1:2001 *Medical electrical equipment –Part 1-1: General requirements for safety. Collateral standard: Safety requirements for medical electrical systems.*

[2] EN 60601-1-2:2002 *Medical electrical equipment – Part 1-2: General requirements for safety. Collateral standard: Electromagnetic Compatibility-Requirements and tests.*

[3] EN 60601-2-37:2001+A1:2005 *Medical electrical equipment – Part 2-37: Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment.*

[4] UL 2601-1:2003 M*edical Electrical Equipment – Part 1. General Requirements for safety.*

[5] CSA C22.2 No. 601.1–M90:2001 *Medical Electrical Equipment – Part 1. General Requirements for safety.*

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